



Angels Beach Vegetation Management Plan



March, 2004

This vegetation management plan supercedes all previous vegetation management plans written for this area

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Work previously undertaken by Shirley White and Grant Woolcock has been used extensively in this assessment plan.

Shirley White has been the inspiration and driving force behind the restoration and protection of the Angels Beach site. Shirley has been recognized for her work through a number of awards, the most recent being for 'Outstanding Contribution to Community Bush Regeneration' presented by the Australian Association of Bush Regeneratores.

All photographs in this report, unless otherwise credited, were taken by Andy Erskine .

EXECUTIVE SUMMARY

Ballina Shire Council has contracted EnviTE NSW to compile this vegetation management plan as a planning document that provides for sustainable and appropriate bush regeneration and coastal land management principles. The plan aims to improve habitat for wildlife, conserve threatened species and forest types, reduce erosion, improve public amenity, and encourage wider community interest and participation in managing the coastal environment. The management plan is a part of Precinct Plan 4, from the Ballina Coastal Reserve Plan of Management. Landcare groups, Dunecare groups, council workers and general community members will all benefit from this plan.

The plan provides strategies, methods and a prioritised work program for restoration of coastal dune vegetation at Angels Beach. The guidelines incorporate current best practice in ecological restoration.

Angels Beach is located in the Ballina Shire in Northern NSW. The area of study is bound to the south by Black Head and to the north by Sharpe's Creek, a small estuary to the north of Flat Rock.

Residential development, weed infestation, fire, sand mining and quarrying have disturbed and reduced the area of original vegetation. Ballina Shire Council in conjunction with the Angels Beach Community Dune Care and Reafforestation Inc. and the Beachfront Parade Dunecare Group are working together to enhance and restore this site.

Site inspections and field surveys were conducted from November, 2003 to February, 2004. The site has been separated into 23 main work zones. In addition to these zones there are sub zones listed alphabetically. A summary of recommended works for each area, general recommendations and suggestions on the allocation of responsibility for each activity are provided.

Recognised weed treatment methods are covered as are the specific treatment methods for dominant weed species recorded at Angels Beach sites.

The native vegetation at Angels Beach and Black Head is valuable in environmental, social, recreational and economic terms. Sustainable management will provide benefits to those who enjoy this scenic area of coastline into the future.

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1. AIMS AND OBJECTIVES OF THE PLAN

Aim

The aim of this Vegetation Management Plan is to provide strategies, actions and a works schedule to assist in the restoration of the structure, function, integrity and dynamics of the native vegetation communities at Angels Beach, Ballina Shire.

Objectives

The objectives of the Vegetation Management Plan and its recommended works are:

- to assess the condition and regeneration potential of native vegetation,
- to provide information on weed species, weed control and restoration techniques,
- to identify and assess threats that are contributing to the degradation of vegetation communities,
- to make recommendations for the restoration of the vegetation communities
- to suggest best practice methods to undertake vegetation restoration with the aim of maintaining dune stability and improving resistance to erosion,
- to consolidate the existing vegetation through the planting of local native species in areas where natural regeneration is least likely to occur (i.e. sites that are highly disturbed and/or physically compacted),
- to increase public awareness of the importance of coastal vegetation and encourage local stewardship for the area,
- to act as a supporting document for further funding

Proposed Outcomes

The plan aims to provide practical guidelines to those involved in restoration, to:

- enhance the resilience and regenerative capacity of the current native vegetation,
- reduce the potential for exotic plants to become established,
- provide a suitable habitat for local and migratory native fauna,
- improve the general amenity for local residents and visitors (aesthetic, recreational and educational).

2. BACKGROUND

2.1 Location

Angels Beach is located in the Ballina Shire in Northern NSW (see **Figure 1**). The area of study is bound to the south by Black Head and to the north by Sharpe's Creek, a small estuary to the north of Flat Rock. The beach is approximately two kilometres in length. The study site is approximately 70 hectares.



**Figure 1: A map of Angels Beach showing proximity to other landmarks.
(Land and Property Information NSW, Ballina 9640-3N, 1:24000 Orthophoto)**

2.2 Climate

The region has a warm temperate climate with a pronounced summer/autumn “wet” season and “dry” mild winters. It is one of the wettest areas (mean annual rainfall 1734mm) in New South Wales. March is generally the wettest month and August the driest, having 3% of the annual rainfall. The period June to October generally receives 20% of the annual rainfall. Cyclonic depressions off the Queensland coast are responsible for some of the most erosive rainfall within NSW.

Frosts are generally absent in the immediate coastal strip. Strong winds are experienced in summer and are predominately from the south-east. These winds are influenced by the Pacific Subtropical air mass. Winds from the north are influenced by the Tropical Maritime air mass. Refer to **Figure 2** for seasonal wind patterns in Byron Bay (25 kms north of Angels Beach).

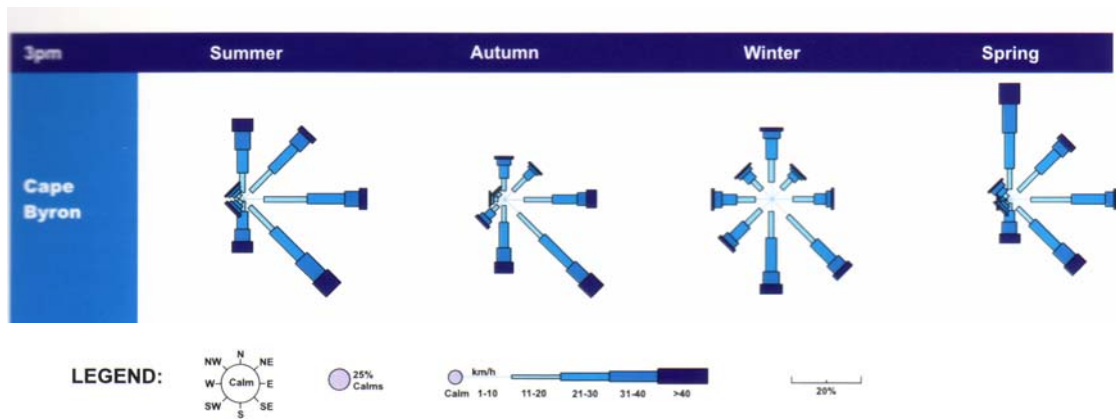


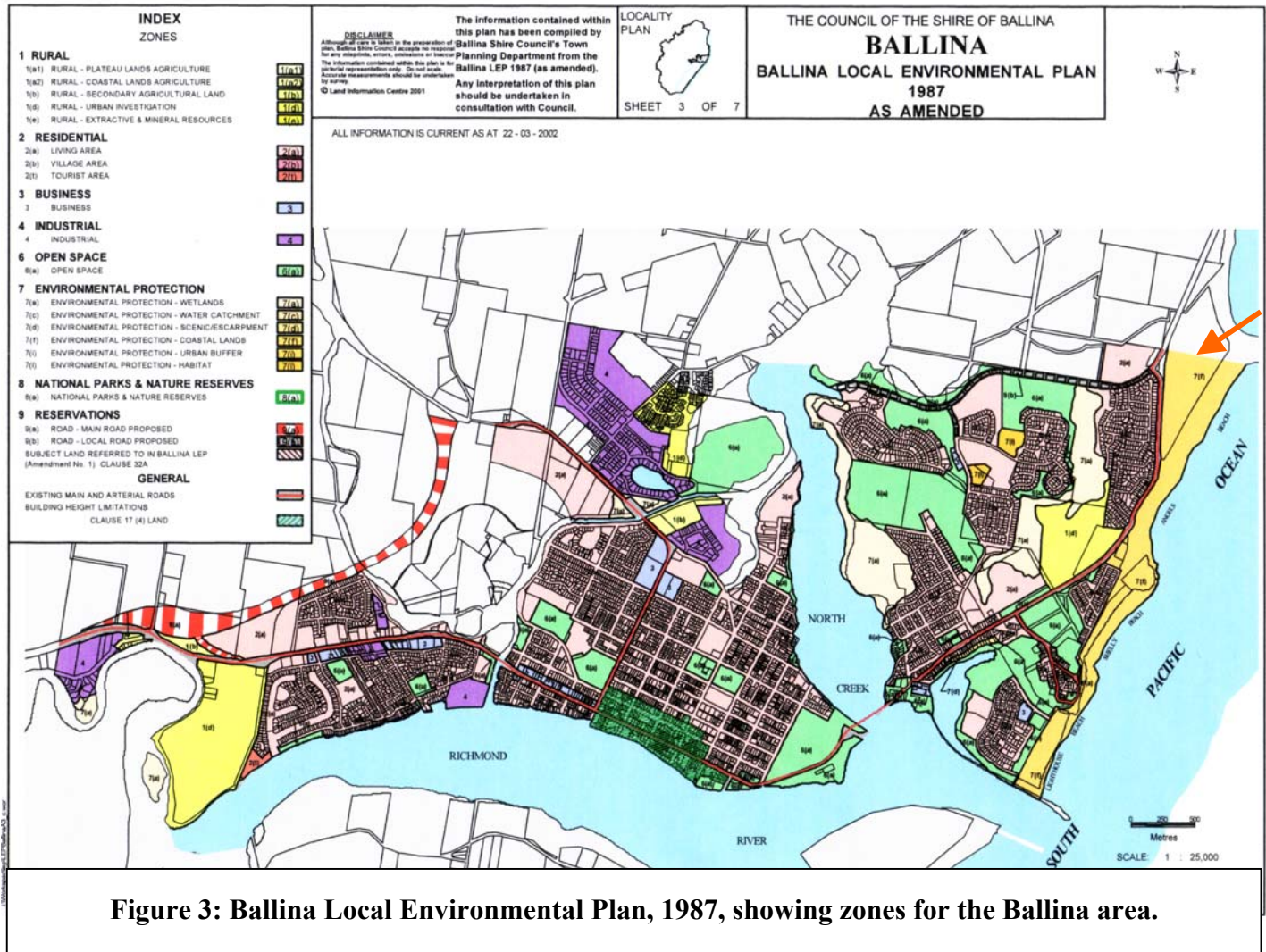
Figure 2: Seasonal wind roses showing wind direction at Cape Byron headland (Kidd, 2001)

2.3 Land Tenure

Angels Beach is crown land reserved under Ballina Local Environmental Plan (LEP) as a Coastal Protection Zone (7f). The primary objectives of this zone are to protect environmentally sensitive coastal land and prevent development which would adversely affect or be adversely affected, in both short and long term, by the coastal processes.

The secondary objective according to Ballina Shire Council (2003) is to enable the development of public works and recreation amenities where such development does not have significant detrimental effect on the habitat, landscape or scenic quality of the locality.

The 7f land to the west of Flat Rock is classified as ‘Operational’ (see **Figure 3**). According to the Land Register definition this land is able to be disposed of as individual private freehold land. Land can be used for utilities or investment in compliance with Coastal Protection Zone objectives.



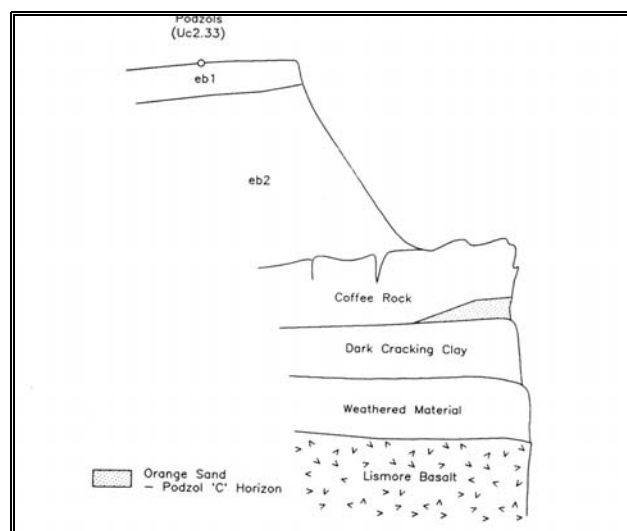
2.4 Geomorphology

Black Head the headland to the south of Angels Beach is of particular geologic interest, according to the Richmond Valley Naturalists Club and Lismore Gem and Mineral Society (1975). It is a basalt outcrop containing vughs with zeolites, calcite and other minerals. The top is covered by an ancient sand dune formed between ice ages when the sea level was several hundred feet higher than at present.

This landscape is classified by Morand (1994) as elevated Quaternary (Pleistocene) dunes forming very low undulating rises blanketing Lismore Basalts. Relief is 15-30m, slopes 3-10%. Elevation is 20-50m.

White and Woolcock, (2000) report that in 1962 Black Head was used as a quarry by the NSW Public Works Department to provide basalt for the extension to the northern seawall at the mouth of the Richmond River.

Photos of the original and current headland form can be seen in Plates 1 and 2.



KEY

eb1- black, water repellent, loamy sand.

eb2- bleached sand

(Morand, 1994)

Figure 4: Schematic cross-section of East Ballina (Black Head) soil landscape illustrating the occurrence and relationship of the dominant soil material.

2.5 Site History

2.5.1 Aboriginal habitation

Aboriginal people have lived in and visited the Ballina area for at least 22,000 years. The New South Wales north coast is the traditional ‘country’ of the Bundjalung people.

Ainsworth (1922) recorded a massacre by Queensland troopers in 1853 or 54 that resulted in the death or forced removal of this Bundjalung tribe (approximately 400-600 people) from their homelands. The bodies of aborigines killed in the massacre were thrown over the cliffs at Black Head (**Plate 2**). A plaque has been erected at the Gunundi Centre to commemorate the massacre (**see Plate 3**).

For thousands of years, local Aborigines benefited from the presence of a wide range of food sources including shellfish and fish on the coast. The rainforest provided many small animals and an abundance of vegetable products. Fibre nets were constructed and joined together to form sections up to two kilometres in length. When game was plentiful the tribe would form the net into a semicircle fence, and then proceed to herd the game into the net where they would be entangled and speared. The nets were also used for fishing, whereby the nets would be mounted on sticks to trap the fish (Ainsworth, 1922).

This management plan acknowledges the living culture of local Aboriginal people and that these places are part of country and are of cultural, social and recreational importance. Consultation with the local Aboriginal community should occur to ensure the protection of cultural and heritage values of these areas.

A number of plants in the area are culturally significant to the Arakwal people of the Byron region. NSW National Parks and Wildlife Service have published a booklet, *Place of Plenty – Culturally Useful Plants around Byron Bay (2003)*. This book particularly includes plants remembered today by elders living in Byron Bay, and plants used elsewhere within Bundjalung country. Appendix 3 includes some of these plants.

2.5.2 European discovery

The coast in the vicinity of Ballina was first mapped and described by Captain Cook on May 15, 1770. Cook spent only one day in the area and did not land but named Cape Byron and Mount Warning while sailing past. Cook failed to notice the entrance to the Richmond River but noted the presence of about 20 people on what is now Seven Mile Beach, just to the south of Broken Head. Sir Joseph Banks also noted these people and remarked that they completely ignored the presence of the Endeavour. This would seem to indicate that the Endeavour was not the first ship that they had seen (Richmond River Historical Society, 1997).

On August 20, 1828 Captain Henry Rous in the HMS Rainbow dropped anchor at Byron Bay. His mission was to discover a navigable river and safe anchorage site. On August 26, 1828 Rous discovered the entrance to the Richmond River and explored several miles upstream (R.R.H.S, 1997).

2.5.3 European settlement

Discovery of the Richmond opened up the Big Scrub rainforest to timber getters searching for Red Cedar (*Toona ciliata*) and Hoop Pine (*Araucaria cunninghamii*). These timbers were in high demand for cabinet making and commanded high prices, encouraging over exploitation.

As the land was opened up by timber getters, it was settled and further cleared by pastoralists under the Robertson Land Acts of the 1860's. These Acts encouraged the taking up of smaller portions of land, which was conditional upon its 'improvement'. In practise this meant the clearing and fencing of land to enable pastoral and agricultural uses (NPWS, undated). These early settlers faced difficult conditions.

2.5.4 Recent environmental history

"Angels Beach has also undergone a number of major environmental changes in the last forty years. Sand mining in the 1950's – 1970's altered the topography, hydrology and ecology of the area when the large dunes were levelled. Local native plants were removed and a road was constructed at the southern end of the beach. In the area to the north of the current overpass the introduced species Tea Tree (*Leptospermum laevigatum*) and Horsetail She-oak (*Casuarina equisetifolia*) were planted after sand mining took place.

A hot bushfire in the mid 1970's further altered the plant communities favouring Coastal Banksia (*Banksia integrifolia*), Paperbark (*Melaleuca quinquenervia*, various Eucalypts (*Eucalyptus sp*), Wattle (*Acacia sp.*) and heath species. Littoral rainforest species recolonised the moist, wind protected areas in the hind dunes.

In 1992, a hot fire in the southern hind dune area destroyed a hectare of the protective tree canopy. Regrowth of Bitou Bush (*Chrysanthemoides monilifera ssp rotundata*) and Coastal Wattle (*Acacia sophorae*) have dominated over the slower growing littoral rainforest species. A cooler back-burn, from the Heritage Walk (north) area to the north-east contained the fire and saved canopy trees such as banksias, paperbarks, tuckeroos and lilly pillies in this area.

During 1995, to the north of the Angels Beach car park, a two metre wide bitumen bicycle track was laid following the old sand mining road parallel to the coast and a pedestrian overpass was constructed by Ballina Shire Council.

In 1996 an underpass to facilitate safe beach access was installed to link the Bayview Drive south and the Prospect and Chickiba Estates, East Ballina. A bicycle track was also laid from the overpass south to Shelley Beach Road. The bicycle track was also laid from the Flat Rock Estate via the underpass" (White and Woolcock, 2000).

Ballina Shire Council proposes an extension of the bicycle track to Flat Rock tent park from the overpass. The track runs parallel with the Coast Road. A Development Application is currently (March, 2004) on public display and when approved will lead to the next stage of the track.

Aerial spraying of Bitou Bush using Roundup® combined with direct seeding of Coastal Wattle on the foredune areas was undertaken in June, 2003 (Erskine pers comm., 2004). The spraying according to White and Woolcock, (2000) was undertaken in rows leaving a strip of vegetation between each row on the foredune area. Direct seeding of Coastal Wattle was undertaken at the same time. Follow up treatment by volunteers removing bitou seedlings/ weeds and planting with appropriate species proved to be successful.



Plate1: Black Head before quarrying that commenced in 1962.



Plate 2: Black Head after the landform had been altered by rock quarrying activities.



Plate 3: Plaque erected in memory of the massacred Bundjalung.

2.6 Site Values and Use

The Ballina area, of which Angels Beach is a part, is valued for its recreational opportunities, environmental significance and scenic qualities for both residents and visitors. The cover photo of this report provides a view of the scenic qualities of this section of coast.

Despite habitat loss and fragmentation (see **Figure 5 and 6**) throughout the study site the area continues to be one of high ecological value. Development pressure has modified the existing vegetation structure. These changes have necessitated the formulation of a management plan to ensure the viability of the coastal ecosystem is maintained.



Figure 5: Aerial photo of the northern section of the study site showing contours (yellow) and drainage lines (blue). Flat Rock can be seen in the lower half of the photo (Ballina Shire Council, 2003).



Figure 6: Aerial view of the southern end of the study site. The photo includes contours (yellow) and drainage lines (in blue). Black Head can be seen in the lower half of the photo (Ballina Shire Council, 2003).

3. COMMUNITY DUNE CARE AND REAFFORESTATION GROUPS.

The Angels Beach Community Dune Care and Reafforestation Group Inc (ABC DR Inc). was formed in 1989 to maintain and conserve the coastal ecosystem of Angels Beach area. This aim is achieved through the construction of public facilities, bush regeneration, dune stabilisation, research and environmental education. The group became incorporated in September, 1999.

Permission for the ABC DR Inc. to work on Crown Land at Angels Beach was granted in 1989, by the Soil Conservation Service (now Department of Infrastructure, Planning and Natural Resource Management) and Ballina Shire Council. In 1995 the elders of the Jali Local Aboriginal Land Council granted permission for the ABC DR Inc. group to carry out work on Black Head.

Public facilities are designed to minimise land degradation while addressing public needs. Facilities provided by the ABC DR Inc. include beach access tracks, steps; fences, formalised, graded walking trails, viewing platforms, informative signs and tree species name plaques. These have all been installed by Dune Care volunteers and include eight accesses (six with board and chain), six viewing platforms and 4000m of fencing.

Locally collected native seeds for revegetation and erosion control works are propagated by Dunecare group members and friends, Southern Cross K-12 and Dorrroughby Environmental Education Centre students and are planted where regeneration is sparse.” (White & Woolcock, 2000)

A second group, the Beachfront Parade Dunecare Group comprising of residents from Beachfront Parade, are working on an area approximately 75m in length and forming the northern part of Zone 18 (refer to **Figure 8**). The working zone extends from the Coast Road to the frontal dune.

4. SITE ASSESSMENT

4.1 Methods

Field surveys were conducted in November, 2003 through to February, 2004 and aerial photo interpretation was undertaken in conjunction with ground truthing. Native and weed plant species were identified (**Appendices 1 and 2**). The location, extent and condition of native vegetation were assessed and management recommendations developed for each area (see Section 5).

Full listing and profiles of all weed species are included in **Appendix 2 and 4**. The dominant native vegetation is also identified. These native species are listed and sites where they have been recorded have been included in the vegetation table. The condition and adequacy of fences, access paths and other facilities was also assessed.

The site has been divided into work areas (see **Figure 7 and 8**) and tasks to be undertaken, prioritised. The ABCDR Inc. are the primary caretakers of the area being managed and ensure regeneration work is carried out in a sustainable way.

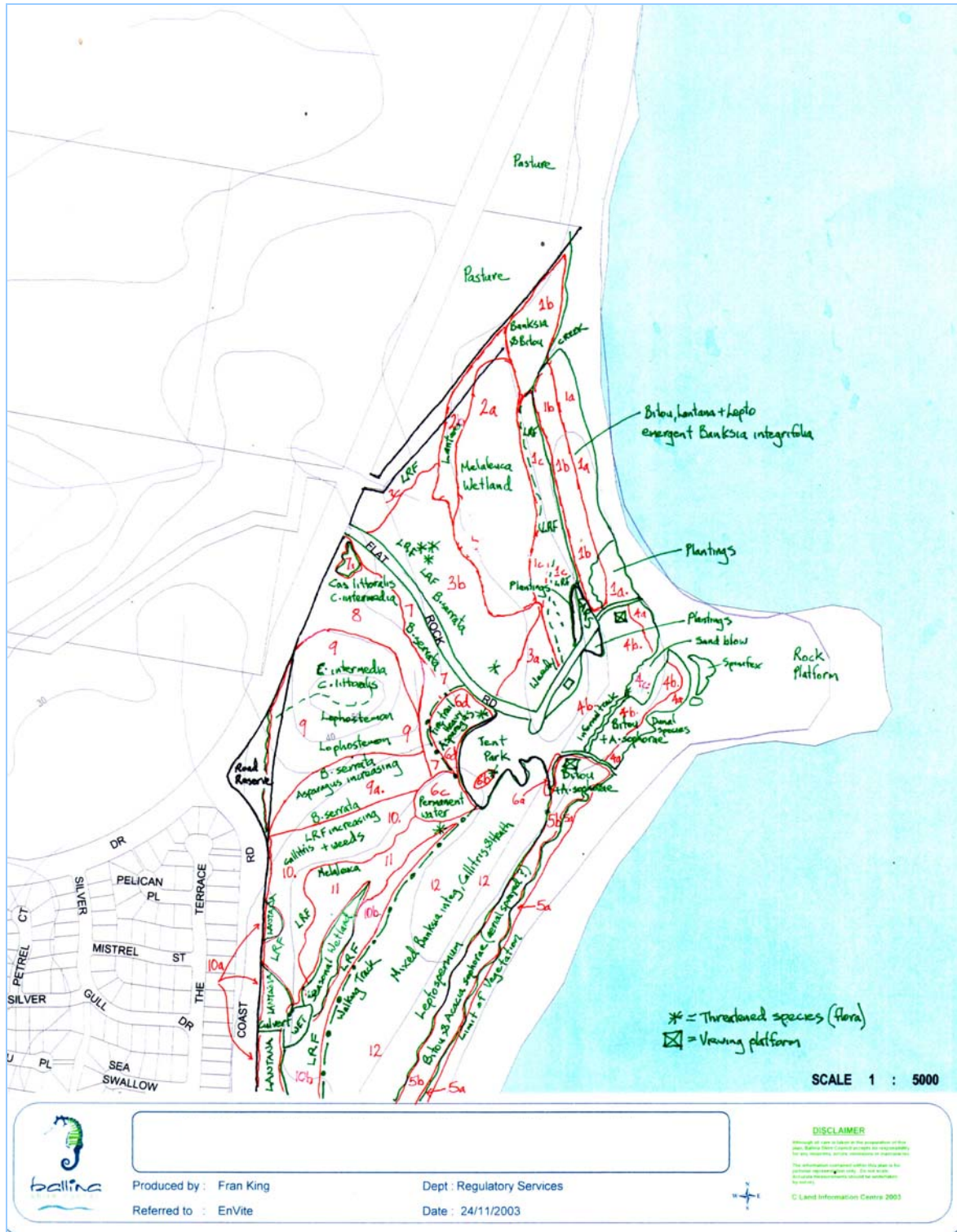


Figure 7: Map of the northern part of the study site showing work sites and their associated zone numbers. (base map - Ballina Shire Council, 2003). Worksite areas included in green and red illustrated by Andy Erskine.

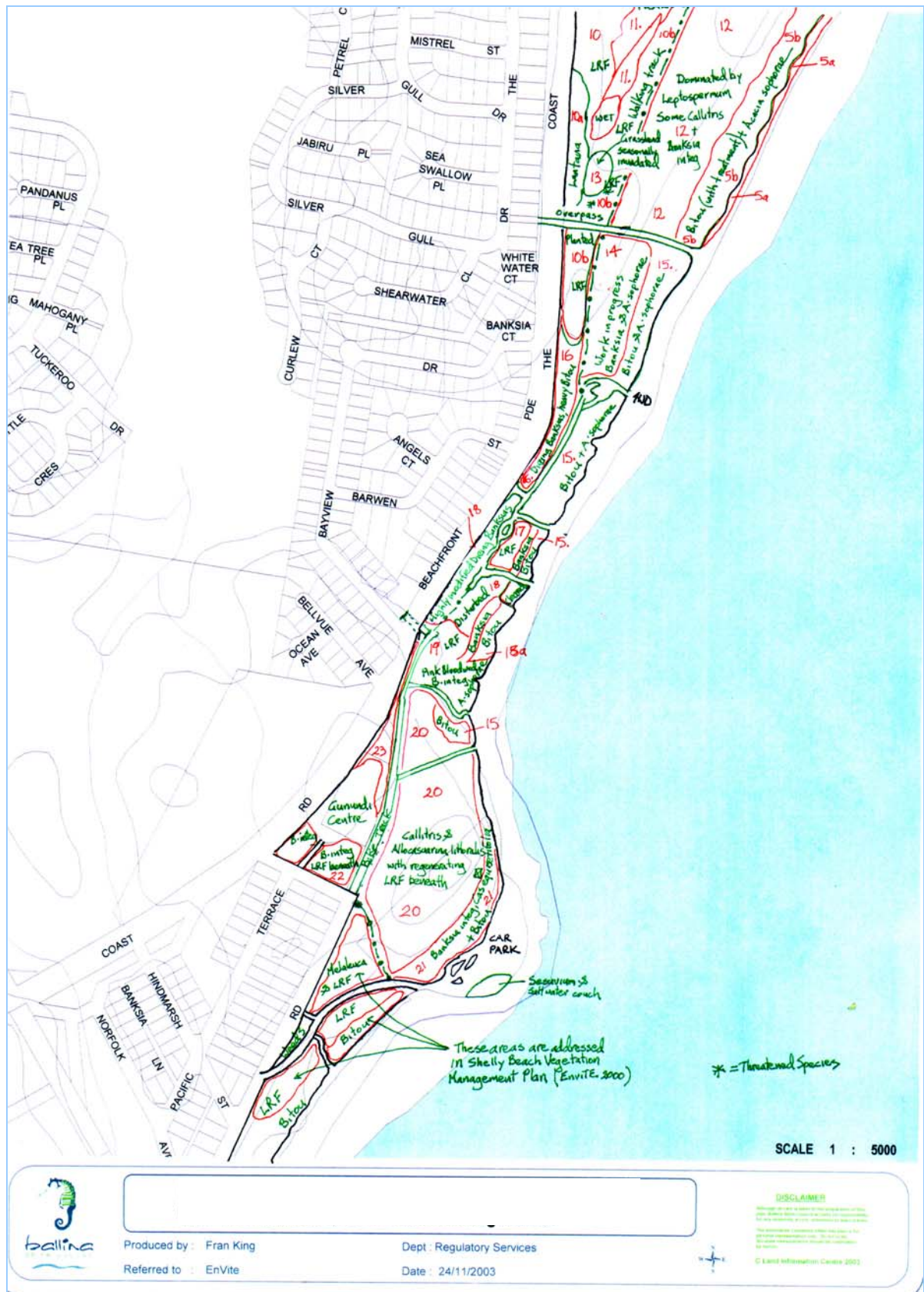


Figure 8: Map of the southern part of the study site showing work sites and their associated zone numbers.(base map - Ballina Shire Council, 2003). Worksite areas included in green and red illustrated by Andy Erskine.

5. MANAGEMENT STRATEGY AND RECOMMENDATIONS

Table 1: Management recommendations for Angels Beach

KEY:Condition rating.

1= weed dominated, native trees absent or dead.

2 = weed dominated with a few emergent native trees and shrubs.

3 = has structure of forest or original vegetation type with heavy weed infestation leading to rapid decline.

4 = has structure of forest or original vegetation type with heavy weed but some natural regeneration.

5 = has structure of original vegetation type with a number of stratum, healthy but threatened by encroaching weeds.

6 = vegetation in good order, sporadic weeds.

7 = forest or system self sustaining, needs no assistance.

Zone No (see Figure 7) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p>1. <u>From Flatrock Carpark to Sharpes Creek.</u></p> <p>1a. Foredune. Well-developed incipient dune the corner of which is fenced in Baco®. (see Plate 4) Foredune dominated by Bitou Bush (<i>Chrysanthemoides monilifera ssp rotundata</i>) with emergent Coastal Banksia (<i>Banksia integrifolia</i>) and Coastal Wattle (<i>Acacia sophorae</i>). Acacia more frequent in southern corner where planted by Dunecare group.</p>	<p>4.</p>	<ul style="list-style-type: none"> • No work required on incipient dune. • Consider future aerial spraying for Bitou on foredune, existing native vegetation should in time fill voids. (Carry out activity after hind dune work is complete). • Monitor regrowth and program for annual aerial spraying work. 	<p>Low</p> <p>Low</p>	<p>Ballina Shire Council (BSC)</p> <p>Angels Beach Dunecare and Reafforestation Group (ABDRG)</p>

Zone No (see Figure 7) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>2. Northern wetland between Flatrock Road and Sharpes Creek.</u> Coastal wetland dominated by regrowth Broad-leaved Paperbark (<i>Melaleuca quinquenervia</i>) (Plate 6).</p> <p><u>2a. North eastern section.</u> Dense forest of healthy Melaleuca with heavy infestation of lantana on the edge, native vines <i>Smilax</i>, <i>Flagellaria</i> and <i>Parsonsia</i> providing wind protection on edges. Sporadic growth of Umbrella trees but few other weeds beyond the edge.</p> <p><u>2b. Western edge of wetland.</u> Melaleucas and proximal species being smothered by heavy canopy of Water Vine (<i>Cissus antarctica</i> + <i>hypoglauca</i>). The crowns have been lost from many trees. Lantana forms an edge between this and adjoining pasture.</p>	<p>5.</p> <p>5.</p>	<ul style="list-style-type: none"> • Overspray Lantana with Glyphosate but retain in situ for wind protection of anticipated emergent native seedlings. Break up Lantana at a later date when brittle. • Treat all Asparagus fern in the area using Metsulfuron Methyl. • Stem inject Umbrella trees. • Treat exotic vines and other weeds as they are encountered. • Thin native vines where they are stressing supporting trees. • Inspect and repeat treatments at 6 monthly intervals. <ul style="list-style-type: none"> • A good site for photo monitoring. Establish photo point. • If resources available (e.g. Greencorp team) manually chop up Lantana and treat stumps working from fence in west to wetland edge. • Sever stems of native vines but do not apply herbicide, do not attempt to pull down stems, allow to naturally deteriorate. • Spot spray site at 6 weeks for weed regrowth. • Repeat spot spraying at 6 monthly intervals 	<p>Medium</p> <p>High Medium Low Low Medium</p> <p>Medium</p> <p>High</p> <p>Low Medium</p>	<p>(ABDRG)</p> <p>Contractors (ABDRG) (ABDRG) (ABDRG) (ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG) (ABDRG)</p>



Plate 1: Well developed incipient dune protected by fencing.



Plate 3: Zone 2a, dense forest of Melaleuca.



Plate 2: Dense Ground Asparagus forms an understory in Zone 1.



Plate 4: Trees being smothered by the native vine Cissus sp.



Plate 5: Blowout area devoid of vegetation, Zone 4c.



Plate 6: Zone 5b, brown area indicates Bitou that has been aerial sprayed.



Plate 7: Aerial view of Flat Rock tent and car parks



Plate 8: Permanent wetland area in Zone 6c.

Zone No (see Figure 7) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>8. Western boundary and northern slopes of Flatrock hill.</u> Coastal She-oak (<i>Casuarina littoralis</i>), Pink Bloodwood (<i>Corymbia intermedia</i>) and Brush Box (<i>Lophostemon confertus</i>) with heath understory dominant on higher slopes. Banksia (<i>Banksia serrata</i>) increases as descend. Beach Acronychia (<i>Acronychia imperforata</i>) becomes common to east of speed bump on road. Asparagus and Lantana occur mainly on northern edge but is relatively light until Zone 7 is encountered.</p>	<p>5.</p>	<ul style="list-style-type: none"> • Spot spray Asparagus with Melsulfuron at rate of 1g per 10L of water (+ surfactant), repeat annually. • Cut Lantana up and spread as mulch, cut, scrape and paint stumps. • Stem inject Umbrella Trees when encountered. 	<p>High Medium Medium</p>	<p>Contractors or (ABDRG) (ABDRG) (ABDRG)</p>



Plate 9: Zone 7 on the right. Road to Flat Rock tent park.



Plate 11: View to Flat Rock from the highest point, Zone 9.



Plate 10: Mysterious unvegetated sand area.



Plate 12: Brushbox and Xanthorrhoe forest, Zone 9a.

Zone No (see Figure 7 and 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>10. In low areas adjacent to Coast Rd south to overpass.</u> Mixed littoral rainforest and Cypress (<i>Callitris columellaris</i>) forest (Plate 16). Dense understorey of Asparagus and large patches of Lantana (Plate 17). Many other environmental weeds are present. Canopy established. No works have been conducted previously in this area.</p> <p><u>10a. Dense Lantana patches on edge of Coast Rd.</u></p> <p><u>10b. Littoral Rainforest.</u> Cypress Pine and Pink Bloodwood supplemented by planting on southern edge. A diversity of naturally occurring mature species and juvenile <i>Cryptocarya foetida</i> (Plate 19) present. Plantings have established well and have formed a closed canopy. Asparagus fern (increasing to the north) is the main problem.</p>	<p>4.</p> <p>2.</p> <p>5.</p>	<ul style="list-style-type: none"> • Beginning from southern edge, blanket spray Asparagus with Metsulfuron at a rate of 1g per 10L of water (+ surfactant), repeat annually. • Overspray patches of Lantana with Glyphosate. • Treat other weeds (Murraya, Senna etc) with appropriate methods. • Sever native vines where they threaten the vigour of native trees. Leave cut vines in the trees to deteriorate. • Cut Lantana and spread as mulch, cut, scrape and paint stumps. Plant heavily with local littoral rainforest species. Ongoing maintenance will be required. • Erect shadecloth fences and Dunecare signs to discourage garden waste dumping. • Beginning from the southern edge, spray Asparagus with Metsulfuron at rate of 1g per 10L of water (+ surfactant), repeat annually. • Treat other weeds (Murraya, Senna, Lantana etc) with appropriate methods. 	<p>High</p> <p>High</p> <p>Medium</p> <p>Medium</p> <p>High</p> <p>Medium</p> <p>High</p> <p>Medium</p>	<p>Contractors</p> <p>Contractors</p> <p>Contractors or (ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG)</p>

Zone No (see Figure 7 & 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>11. Permanent and seasonal wetland in low area between the Coast Rd and the north-south walking track.</u> Melaleuca developing in colonies showing evidence of a past fire event. There are few weeds due to seasonal inundation. Ponds contain dense stands of Sedge (<i>Lepiromia articulata</i>).</p>	6.	<ul style="list-style-type: none"> • Cut Lantana and spread as mulch, cut, scrape and paint stumps. • Spot spray Asparagus with Metsulfuron at rate of 1g per 10L of water (+ surfactant), repeat annually. • Treat <i>Ipomoea cairica</i> by scrape & paint or hand remove. • Drainage pattern is scheduled for improvement by Council. • Ponds require no work. 	<p>Medium High High</p>	<p>(ABDRG) (ABDRG) (ABDRG)</p>



Cryptocarya foetida seedling



Tripladenia cunninghamii



Plate 13: The Coast Road boundary, Zone 10.



Plate 15: Tailings fom Zircon and Rutile mining.



Plate 14: Dense infestation of Lantana on the edge of the road.



Plate 16: Juvenile *Cryptocarya foetida*.

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>12. Eastern side of walking track from overpass to tentpark.</u> Much drier vegetation found on this side of track possibly due to past alterations in drainage associated with sand mining. The area supports Callitris forest with large areas of aged <i>Leptospermum laevigatum</i> that continue to flower and seed. These were likely planted following sand mining. Leptospermums have a tendency to collapse in high wind events crushing native vegetation that is emerging (Plate 20). Little natural regeneration is present beneath either colony due to the toxic sand layer created by the breakdown of organic matter derived from these species. Fallen trunks are a hazard and difficult to cut for removal due to their hardness, this presents a a fire hazard. The understorey is dominated by Asparagus, control undertaken by Dunecare group, regeneration has improved in these areas. Patches of terrestrial orchids occur at this site.</p>	<p>3.</p>	<ul style="list-style-type: none"> • Beginning from overpass, blanket spray Asparagus with Melsulfuron at rate of 1g per 10L of water (+ surfactant), repeat annually but schedule to avoid subterranean orchids that occur beneath Callitris in autumn. • Overspray patches of Lantana with Glyphosate. • Treat other weeds (Bitou, Senna etc) with appropriate methods. • Annually clear a strip of Leptospermum in this zone 10 to 20 m wide, commencing with the western edge. Prune these trees back to the trunks and utilise these for brushmatting works. • Cut the remaining large limbs and trunks to ground level using the services of a professional tree lopper, (note the timber is hard). Consider stock piling for future sale as firewood, a potential fundraiser for the group. • Plant the cleared area with LRF species. • Repeat the treatment annually until all Leptospermums are removed. 	<p>High</p> <p>Medium Medium</p> <p>Medium (when LRF stocks are available)</p> <p>Medium</p> <p>Medium</p>	<p>Contractors</p> <p>Contractors assisted by (ABDRG) (ABDRG) Work for the Dole program</p> <p>Ballina Shire Council</p> <p>(ABDRG)</p>

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>13. Grassland in the forest adjacent to the Coast Road north of the overpass.</u> Area occasionally flooded, dominated by native grasses, no weeds (Plate 20).</p>	<p>6.</p>	<ul style="list-style-type: none"> • Leave as is; monitor to observe possible changes associated with the revision of drainage proposed by Council. • Melaleuca plantings can be continued but consider the value of this grassland as specialist habitat for resident fauna. 	<p>Low Low</p>	<p>(ABDRG) (ABDRG)</p>
<p><u>14. Hind dune area that has received weed control and undergone extensive planting.</u> Dense <i>Acacia sophorae</i> and Bitou have been retained on the crest of the dune to provide wind protection to the work area behind, this is an appropriate strategy. Plantings are correct in diversity and will fill the area soon.</p>	<p>4. weeds being controlled</p>	<ul style="list-style-type: none"> • Continue with the current strategy and model of planting. • Follow up weed control to be conducted as required. 	<p>High Medium</p>	<p>(ABDRG) (ABDRG)</p>

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>15. Fore dune areas south of 4WD track.</u> Dominated by Bitou Bush (Plate 22) but does contain <i>Acacia sophorae</i> and emergent <i>Banksia integrifolia</i>. Some areas in this zone are seasonally inundated forming shallow lagoons. Some sand blowouts are forming in the frontal dune</p>	2.	<ul style="list-style-type: none"> • Clear Bitou manually from beneath emergent Banksias and from the edges of <i>Acacia sophorae</i> colonies to allow for natural expansion. • Future aerial spraying program for a minimum of 3 years when existent native species form at least 30% of the foliage cover on the frontal dune. Accompany aerial spraying with fore dune seed mix (<i>Acacia</i>, <i>Banksia</i> and <i>Lomandra</i>) dropped from helicopter. • Follow-up work on foot 6 months after aerial application targeting large Bitou that survived the spraying. • In areas prone to inundation plant with closely spaced <i>Melaleuca quinquenervia</i> and related species such as <i>Isolepis (Isolepis nodosa)</i>, Swamp Lily/ River Lily (<i>Crinum pedunculatum</i>). These could be used to supplement this planting. • Establish duneforming fences (see Appendix 12) at eastern side of blowouts, brushmat loose areas behind with cut Bitou and <i>Leptospermum</i>. 	<p>Medium</p> <p>Low</p> <p>Low</p> <p>Low</p> <p>High</p>	<p>(ABDRG)</p> <p>BSC</p> <p>(ABDRG)</p> <p>(ABDRG)</p>
<p><u>15a Fore dune between the overpass beach access track and the 4 wheel drive track.</u> The area is poorly drained with seasonal inundation. Recently planted species are unable to survive in these conditions.</p>	2	<ul style="list-style-type: none"> • Plant with closely spaced <i>Melaleuca quinquenervia</i> and related species such as <i>Isolepis</i> Swamp Lily/ River Lily. These could be used to supplement this planting. • Install protective fences to limit pedestrian access to the sand ‘blowout’ areas. Brushmat with cut <i>Leptospermum</i>. 	Low (after the next inundation has killed Bitou)	(ABDRG)



Plate 17: Fallen Leptospermum sp. hamper bush regeneration activities, Zone 12.



Plate 18: Seasonally inundated grassland in Zone 13.



Plate 19: Foredune area south of the 4 wheel drive track, Zone 15. The site is dominated by Bitou Bush with some emergent Banksia and Acacia.

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>16. Gully between the Coast Road and walking track (approximate location between Banksia Court and Barwen St).</u> Mature trees consisting primarily of Banksia and Melaleuca are deteriorating (Plate 24) due to heavy competition from Bitou and Lantana and seasonal water accumulation that may be associated with the establishment of the Coast Road. The area adjoins littoral rainforest in the north and appears to have regenerative potential if weeds are controlled. White passionfruit likely to be persistent.</p>	<p>3.</p>	<ul style="list-style-type: none"> • Erect shadecloth fence 1m high to impede pedestrian shortcuts and install educational Dunecare signs. Establish photo-monitoring points. • Clear Bitou, Lantana and all other weeds manually (this would be an ideal site for a Green Corp team). • Maintain the site through follow-up weed control. • Evaluate natural regeneration after 12 months, if unsatisfactory plant with swamp species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Swamp She-oak (<i>Casuarina glauca</i>), Swamp Box (<i>Lophostemon suaveolens</i>), Paperbark (<i>Melaleuca quinquenervia</i>), Pink Euodia (<i>Melicope elleryana</i>) 	<p>Low</p> <p>Low</p> <p>Low</p>	<p>(ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG) (ABDRG)</p>

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>17. Small patch of LRF to north of Boardwalk access.</u> Tuckeroo is the main species at this site the crown of these are wind burnt despite a protective barrier of Banksia to their east. Works here must maintain wind protection to the littoral rainforest species. Shrublike weeds should be retained if they are contributing to this protective barrier. Control other weeds such as grasses, Asparagus and Madeira vine to allow expansion of existing plants and improve their vigour</p>	4.	<ul style="list-style-type: none"> • Reinforce protective Banksia barrier by establishing further planting of this species to the east of existing trees. • Control weeds amongst and surrounding LRF, plant Beach Alectryon (<i>Alectryon coriaceus</i>) around edges to increase wind protection. 	High High	(ABDRG) (ABDRG)



Plate 20: Typical vegetation type on the incipient foredune along Angels Beach.

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>18. Beachfront Parade Dunecare Area. (Hind dune)</u> Considerable Bitou control and planting has been carried out in the hind dune area and new environmental weeds such as Ground Asparagus, Madeira Vine, Leucaena (Plate 25) and Painted Spurge have continued to reappear. Most of the planting was carried out during the 1990's and needs to be supplemented with suitable species to reduce opportunities for environmental weeds to again dominate. Banksias are in decline. Adjoining areas support remnant LRF species such as Tuckeroo (<i>Cupaniopsis anacardiodes</i>) and Three-vein Laurel (<i>Cryptocarya triplinervis</i>) these and other species represented nearby should form the basis of planting. Some locally rare LRF species exist on the west side of the walking track, between the carpark entrance road and the "Ramp" entrance track There are known colonies of terrestrial orchids present.</p>	<p>Modified, could improve or decline depending on future treatment.</p>	<ul style="list-style-type: none"> • Remove non-endemic planted shrubs <i>Grevillea</i>, <i>Westringia</i> and <i>Leucaena</i> (environmental weed) after bagging seed. • Spray out Asparagus and Mother of Millions using Metsulfuron. • Scrape and paint Madeira Vine. • Remove Painted Spurge through hand removal or Glyphosate application. • Plant area where needed at 1.5m spacings with LRF species as identified in Plant selection Guidelines (Appendix 3b). When these plantings are sufficiently thick to prevent pedestrian short cutting consider removing the post and rail fence on the western edge. • Follow-up weed control at intervals of no longer than 8 weeks or as resources allow. • A training workshop on weed control and pruning techniques should be scheduled for BPDG, to equip members with an efficient and economical strategy for long term success. • Tree pruning to facilitate views from the observation deck in Zone 18 to be carried out by BPDG. • Vegetation trimming behind fences and along tracks to be carried out by BPDG in consultation with EnviTE on 'best practice' methods. <p>*Areas known to contain terrestrial orchids should be treated during Summer when plants are reportedly dormant underground (see Section 5.1.4)</p>	<p>High</p> <p>High</p> <p>High</p> <p>Medium</p> <p>High</p> <p>Medium</p> <p>High</p> <p>High</p> <p>High</p>	<p>Beachfront Parade Dunecare Group (BPDG) or contractors</p> <p>(BPDG) Assisted by EnviTE NSW using Work for the Dole program labour.</p> <p>EnviTE</p> <p>(BPDG)</p> <p>(BPDG)</p>

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>18a. Foredune. Beachfront Parade area (in proximity of elevated walkway).</u></p> <p>The elevated walkway (Plate 27) is well designed and constructed but due to a seasonal erosion scarp on the incipient dune the path may at times terminate in a drop-off to the beach. ‘Holey belt’ matting is folded back or brought forward according to the condition of the scarp. Bitou has been cleared in the near vicinity to the south and plantings have had limited success due to a prolonged dry period following planting. Coastal Tea-tree (<i>Leptospermum laevigatum</i>) has been planted on the foredune to the north of the raised walkway. This species has been forming a monoculture in other parts of the study site and should be gradually removed.</p>	<p>Modified, could improve or decline depending on future treatment.</p>	<ul style="list-style-type: none"> • The drop-off from the end of the ramp to the beach is a natural part of the dynamic nature of the incipient dune. The current method of advancing or withdrawing ‘holey belt’ is considered acceptable. • Replant Banksias and Acacia in cleared area incorporating water-holding crystals in the methodology. • Include Bitou dominated areas to south in aerial spray program detailed in section 15 of this plan. • Retain Tea-trees on the eastern side for wind protection but remove specimens in their lee to allow planting of <i>Banksia integrifolia</i> and <i>Alectryon coriaceus</i>. When these plantings have established remove all Tea-trees. 	<p>Medium</p> <p>Medium</p> <p>Low</p> <p>Medium</p>	<p>BPDG and BSC</p> <p>BPDG or contractors BSC</p> <p>BPDG</p>



Plate 21: Banksia and Melaleuca are deteriorating in Zone 16.



Plate 23: Aerial photo of Zone 18.



Plate 22: The weed *Leucaena leucocephala* recorded in Zone 18.



Plate 24: Elevated walkway providing access to the beach. Holey belt can be seen in the foreground.

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>20. Black Head, east of Gunundi Centre (cliff face is addressed in 21).</u> (sites 20 and 21 can be seen in the aerial photo, Plate 34)</p> <p>Diverse vegetation (Plate 29 and Plate 33) in this zone has likely experienced a fire event or past clearing activities. Signs of this disturbance are reflected in an evident succession from a sclerophyll type featuring <i>Callitris</i> and <i>Allocasuarina littoralis</i> to the recent appearance of LRF species including Blue Lily Pilly (<i>Syzygium oleosum</i>), Tuckeroo (<i>Cupaniopsis anacardoides</i>) and Variable Muttonwood (<i>Rapanea variabilis</i>). Dense <i>Asparagus</i> infestations have been reduced by broad-scale spraying of Metsulfuron by the Angels Beach Dunecare group.</p>	6.	<ul style="list-style-type: none"> • Continue weed control including small Camphor Laurels that were seen at the entrance to the cliff top observation platform (see Appendix 6 for Camphor control methods). • Maintain the north-south track as informal but consider specific treatment in areas where pedestrian safety is at risk e.g. fill depressions, construct small sections of raised boardwalk over exposed tree roots. This track is well used. The Gunundi beach access track is well constructed and in good order. Consider decommissioning one of the tracks that leads from the south of the platform to the south-eastern corner of Black Head as it does not appear to be in regular use. The Heritage Walk track is adequate and serves to link Shelly Beach access track which arrives at the same point as that considered for decommission. • Natural regeneration is prevalent but planting of appropriate species could be considered for smaller problem areas. 	<p>High</p> <p>Low</p> <p>Low</p>	<p>(ABDRG)</p> <p>(ABDRG)</p> <p>(ABDRG)</p>

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>21. Cliff face of Black Head.</u> This area has been extensively modified by past quarrying activities. Due to widespread Bitou infestation and potential risks to workers due to the terrain (Plate 30 and 31) it is suggested that a repeat of 2003's aerial herbicide application be repeated. <i>Acacia sophorae</i>, <i>Banksia integrifolia</i> and <i>Allocasuarina littoralis</i> are already present on the cliff face and with encouragement could eventually out compete Bitou. There is an ongoing issue of pedestrians traversing from the cliff top observation platform to the car park below, this access route is considered unsafe.</p>	<p>Modified, could improve or decline depending on future treatment.</p>	<ul style="list-style-type: none"> • Repeat aerial spraying in 2004 but this time in conjunction with the air-drop of seed from <i>Acacia sophorae</i>, <i>Banksia integrifolia</i> and <i>Allocasuarina littoralis</i>. • Discourage pedestrians accessing the car park from the platform by planting Prickly Acacia (<i>Acacia ulicifolia</i>) where possible. 	<p>High Medium</p>	<p>BSC (ABDRG)</p>



Plate 25: The use of signage in Zone 19.



Plate 27: Bitou infestation on the cliff face in Zone 21.



Plate 26: Species diversity is apparent in Zone 20.



Plate 28: Black Head cliff face profile, Zone 21.

Zone No (see Figure 8) Vegetation description	Condition rating (1-7)	Recommendations	Priority	Work to be performed by:
<p><u>22. South-east corner of the Gunundi centre adjoining Shelley Beach Road.</u> This site has a canopy of Coastal Banksia and Callitris with actively regenerating LRF understory. Dominant LRF species are Tuckeroo, Beach Acronychia and Variable Muttonwood. Angels Beach Dunecare has successfully treated Asparagus infestation.</p>	6.	<ul style="list-style-type: none"> • Maintain weed control program, no supplementary planting required. 	Medium	(ABDRG)
<p><u>23. Area west of bitumen cycle path descending from Gunundi Centre. (Plate 32)</u> This area has undergone weed control works and rehabilitation planting since the installation of the cycle path. Plantings have been undertaken for several metres east and west of the track. Many mature LRF species were already present in the site. This site is responding well under current management by Angels Beach Dunecare group.</p>	6.	<ul style="list-style-type: none"> • Encourage continued stewardship of the area by the Angels Beach Dunecare group. • Continue regular weed control work with particular vigilance on Asparagus and exotic grasses. • North Power vehicles should wash down equipment before entering the area to remove adherent weed seed and vegetative pieces. 	Medium High	(ABDRG) BSC



Plate 29: Cycle path between Zone 20 and 23.



Plate 30: Looking east to Zone 20 where extensive Asparagus Fern treatment has been undertaken by the Dunecare group



Plate 31: Aerial view of Black Head. showing Zone 20 and Zone 21 along the cliff face.

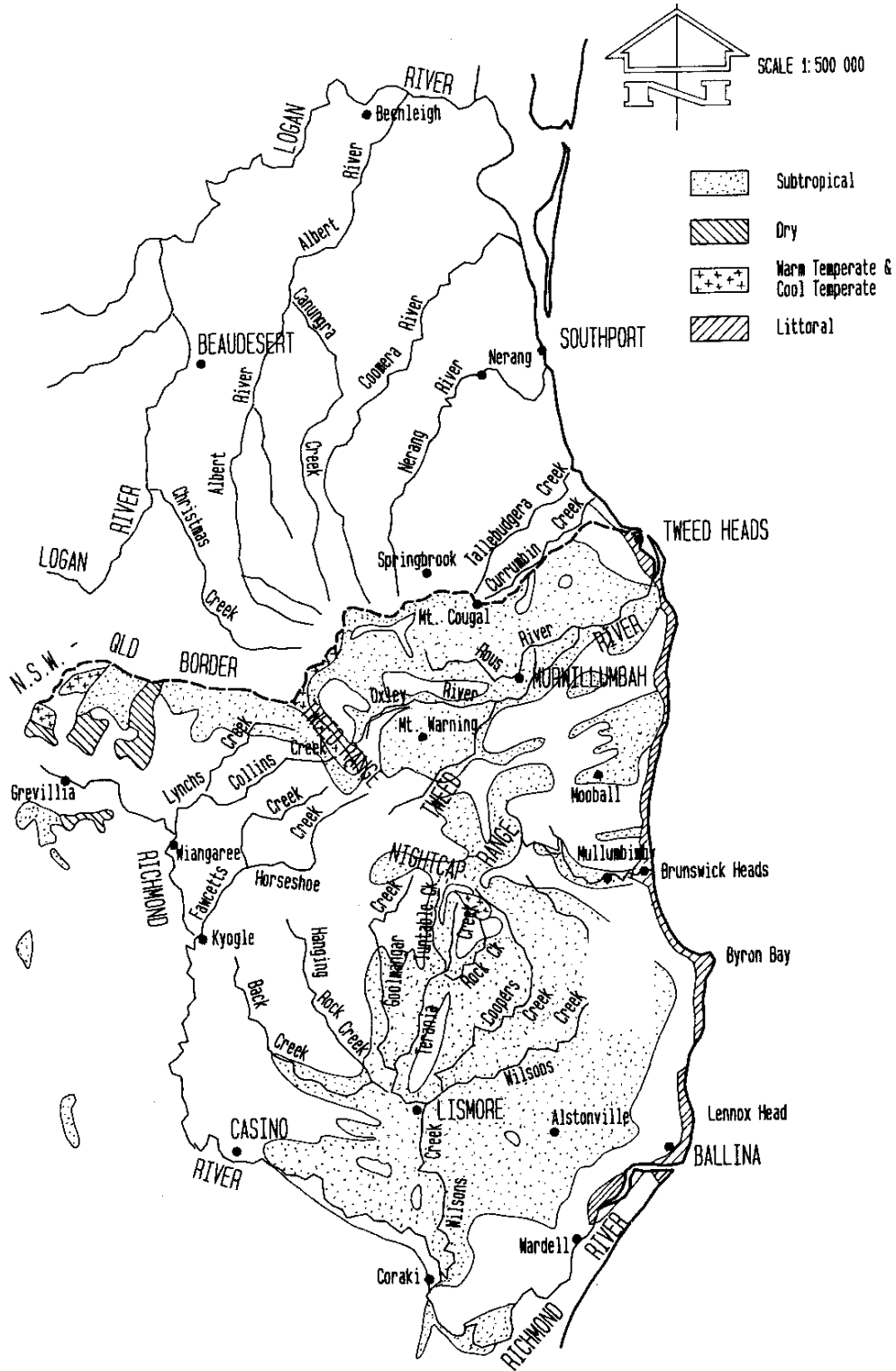


Figure 9: Pre-existing vegetation communities of northern New South Wales. A strip of littoral rainforest is thought to have extended along the entire coast from south of Ballina to Tweed Heads. Source Floyd, 1990

5.1 Vegetation Management Issues

Vegetated dunes will offer increased erosion resistance, but where an exotic species is able to form a monoculture they prove, with a lack of physical complexity, to be poor sand binders. The opportunity for natural regeneration to occur on the dunes is currently restricted due to competition from weeds and few native, seed dispersing trees being present. This requires weed control and in some areas, planting of suitable native species.

5.1.1 General Vegetation Management Recommendations

- The successful implementation of this plan is dependent on adequate resourcing being maintained over the life of the plan to avoid re-infestation of previously worked areas.
- The plan should be implemented under the supervision / coordination of a suitably qualified and experienced bush regenerator to ensure best practices and the health and safety of workers and the public.
- Keep local residents informed through public information campaigns and encourage support. Local business may contribute to costs and can be provided with recognition and publicity of their contribution.
- Work zones systematically, treating weeds as they are encountered in accordance with the specific methods described in Appendix 6. Once an area is treated, workers can move onto the next. It is a good practice to review worked areas prior to commencing work in the current area on each workday, so that regrowth and other problems can be treated immediately and follow-up maintenance is reduced.
- Retain Bitou Bush and Lantana to the east of worked areas if they are providing shelter for regeneration areas and plantings behind.
- Maintain previously worked areas by spraying or hand weeding. Avoid creating piles as these are troublesome later, it is better to cut up material and scatter.
- When breaking new ground always consider what resources are available for follow-up treatments. If you have a team at your disposal confine their activities to an area that they can treat thoroughly or maintenance may become overwhelming. Discuss these limits, objectives and desired results openly with the team as well as the team supervisor to establish a common picture of what needs doing; this will lead to greater mutual satisfaction as well as more effective primary treatment.
- It is recognised that the volunteer time the principal Dunecarers have available for this project is limited. This time is best spent in low volume but frequent application of targeted herbicide, monitoring, and coordination of the available labour market programs that offer their services. Volunteer work should not become onerous.
- The continued and increased use of volunteers in rehabilitation activities is to be encouraged.
- Seed of desirable species should be collected when available (eg. December, January for *Banksia integrifolia*, *Acacia sophorae* and *Cupaniopsis anacardioides*). If plant nursery facilities are not available there is the option of contacting EnviTE to take delivery of this seed for propagation on a cost recovery basis.

5.1.2 Natural Regeneration

Adherence to the recommendations in Table 1 should result in the following sequence of recovery. If this sequence of events is not noted, regeneration activities have not been successful and techniques used may need to be modified or improved.

1. Sprayed areas of Bitou Bush will yellow and die, which will allow more physical space for existing native vegetation to expand and for plantings to be undertaken. Dead material should be broken down by stamping or chopping otherwise it will harbour Bitou Bush seedlings.
2. Green trash, that has been evenly chopped up and left on the ground, will break down and form a moisture retentive mulch (weeds must not be piled up). Aerial vines, that have been severed and left in trees, will deteriorate, so that light is slowly increased allowing plants beneath to acclimatize to increased levels of light and salt. Don't pull vines or material, such as Morning Glory or Bitou Bush, from trees, cut at head height to allow maintenance access and allow to fall.
3. Plantings are most successful in late summer and should be protected by tree guards and planted in the lee of retained organic material. These plantings will gather impetus and, within a three to four year period will achieve a wedge shaped canopy. With the resultant decrease in light, germination of weeds in these areas should be minimal.
4. Diverse groundcovers that have been encouraged to grow on the foredune should quickly colonize unconsolidated sands. Losses will be experienced during erosion events but this will be reduced as the vegetation cover in each area increases. Beach erosion is a natural and dynamic process and must be accepted as inevitable.

5.1.3 Bitou Bush Control

Bitou Bush (*Chrysanthemoides monilifera* subsp. *rotundata*) is a highly invasive introduced species that poses a major threat to coastal ecosystems. Bitou Bush is a native of South Africa. It grows on sand dunes and forest margins near beaches and poses a serious threat to native sand dune vegetation (Harden, 1992, p.315). These plants can invade and overwhelm all plant communities on the coastal system, growing in the open or in the shade of other plants. There is increasing evidence that long-term domination of coastal frontal dunes by Bitou Bush leads to instability and increased erosion (Stanley et. al., 1989).

Bitou Bush was introduced to New South Wales by the Soil Conservation Service and by sand mining companies involved in revegetation of dunes following mining operations. Bitou Bush has been recorded on 900 kilometres (80%) of the NSW coastline and is the dominant plant on 400 kilometres (NSW NPWS, 2001).

Bitou Bush is categorized as one of the top 20 environmental weeds in Australia. Bitou Bush was declared a W3 noxious weed on all coastal land of NSW on March 24, 1998. W3 weeds must be prevented from spreading and numbers reduced. In 1999 Bitou Bush was listed as a *Key Threatening Process to Biodiversity* in NSW and as a *Weed of National Significance* (Vranjic, 1999).

Bitou Bush primarily spreads by seed, with germination promoted by fire or soil disturbance. Mature plants resprout after fire and slashing. Mature plants produce up to 50,000 seeds per plant per year with the seed ripening from June to September.

Foxes and birds eating seeds can aid dispersal over several kilometres. The soil seed bank is large (up to 5000 seeds per square metre), seed viability is generally low (2% – 30%) and considerably reduced after 2 to 4 years (Vranjic, 1999).

Strategic control of Bitou Bush and replacement with Banksia dominated vegetation and littoral rainforest will assist a range of local native plant and animal species, including threatened species.

Examples of fauna that would benefit from restored native plant communities include the Common Blossom Bat (Banksia), Black Flying Fox, Eastern Long-eared Bat (Banksia and littoral rainforest), Barred Cuckoo Shrike (small leaved figs and littoral rainforest), White-eared Monarch (littoral rainforest), Rose-crowned Fruit Dove (littoral rainforest). Birds including the Little Tern, Pied Oystercatcher and Beach Stone Curlew that use the frontal dunes and sand spits for breeding would also have improved habitat following systematic and incremental control of Bitou Bush and replacement with local native plant communities.

Examples of threatened plants that would benefit from Bitou Bush control include Scented Acronychia (*Acronychia littoralis*), *Chamaesyce psammogeton*, Stinking Cryptocarya (*Cryptocarya foetida*), White Laceflower (*Archidendron hendersonii*), and Queensland Xylosma (*Xylosma terrae-reginae*).

Bitou Bush control and restoration of native vegetation communities can make a significant contribution to reversing threats to threatened species. Bitou Bush control involves a range of techniques for a variety of situations. Techniques include manual, biological and chemical controls.

In sandy soils seedlings and small plants are easily removed by hand. This method is time consuming and only practical on a small scale. Attempting to remove advanced plants manually will result in undue soil disturbance.

Glyphosate is the most widely used herbicide for chemical control of Bitou Bush. Application methods include cut, scrape and paint, knapsack spraying and aerial spraying. Aerial spraying (at concentration of 1:200) is most effective in winter. This provides effective treatment of broad infestations in a cost-effective manner. Most native species are not sensitive to such low concentrations of Glyphosate.

A number of biological agents have been used to assist in the control of Bitou Bush. Seven insect species have been released in Australia including moths, beetles and seedflies. Other potential biological controls include a rust fungus and mite. Biological control will reduce but not eradicate Bitou Bush. Their use should be combined with an integrated control program along with strategic herbicide use (Holtkamp, 1997 in James, 2002).

5.1.4 Weed control around terrestrial orchids

Terrestrial orchids have been identified at the Angels Beach site. As these orchids are often inconspicuous they are often overlooked when regeneration works are being undertaken. For example the stem leaves of *Pterostylis longifolia* can superficially

resemble *Tradescantia spp.* and many terrestrial orchid genera have grass like leaves (Baker, 2004).

Baker (2004) goes on to say that most terrestrial orchids flower in Spring or Autumn, although no season is off limits. If spraying of herbicides is undertaken around known populations of orchids, consider timing the treatment for when the orchids are dormant underground. Soil disturbance should be avoided year-round in these areas, so as not to displace tubers. Andresen pers com. (2004) has reported seeing native orchids in this area during winter.

5.2 Revegetation

5.2.1 Plant Selection Guidelines

Some areas of Angels Beach have a low potential to naturally regenerate. Areas cleared of Bitou Bush and other weed species will need to be planted with endemic replacement species. Care should be taken to use an appropriate species that has been grown from seed collected nearby. Nursery propagated material of uncertain origin should not be used. Many species, such as *Banksia integrifolia*, have a very broad geographic range but genetic differences are found across this range. Trees found on the site have adapted to the specific conditions that occur at the Angels Beach site.

The introduction of species that would not naturally occur on this site is not recommended. This can be detrimental to the ecological functions of the vegetation community. If the aim of the restoration project is to facilitate the establishment of the pre-existing vegetation, then planting trees that do not belong will not achieve this aim. Recommended local native species for plantings are detailed in Appendix 3. Species are identified for areas including the hind dune, frontal dune and incipient dune.

5.2.2 Threatened Flora Species

Threatened flora species that have been identified in the Angels Beach study site include Stinking Cryptocarya (*Cryptocarya foetida*), Toothed Palm-lily (*Cordyline congesta*), Plectranthus (*Plectranthus cremnus*) Laceflower (*Archidendron hendersoni*) and Scented Acronychia (*Acronychia littoralis*). Details of threatened flora species that may be found on the Ballina coastline are provided in Table 2.

North-east New South Wales is known to support the highest number of rare or threatened plant species in Australia and is equal to the wet tropics for faunal diversity. The main threats affecting biodiversity along the Ballina Shire coastline include the introduction and establishment of exotic species, pollution, direct exploitation and habitat loss resulting from habitat fragmentation, modification and disturbance.

The objective of the *Threatened Species Conservation Act 1995* (TSA Act) is to conserve threatened species, populations and ecological communities of native animals and plants (NSW NPWS 2002).

The TSC Act provides for:

- The protection of all threatened plants and animals native to NSW (excluding fish and marine vegetation):
- The preparation of recovery and management strategies

- The preparation of threat abatement plans for the management of key threatening processes
- The designation of areas as critical habitat for threatened species, populations and ecological communities ,
- The consideration of threatened species in development control and environmental planning.

5.2.3 Guidelines for working in areas where threatened flora species occur

When threatened species are identified, strategies are required to be implemented to ensure their protection prior to undertaking any works. Responsibility for the recovery of threatened flora species rests with the NSW NPWS who are required to prepare Recovery Plans for each species. At present, Recovery Plans have been prepared for only a small number of species, though many more are in preparation. Recovery actions should be carried out in accordance with those Plans, and supervised by NSW NPWS or their agents (Landmark Ecological Services Pty. Ltd et al, 1999).

Dunecare group members and others who do not have specific skills in habitat rehabilitation are asked to seek advice from qualified bush regenerators and NSW NPWS before working in the vicinity of threatened flora species.

The following information has been summarised using the NSW National Parks and Wildlife Service *Checklist for Bush Regeneration Activities In The Habitat Of Threatened Species, Endangered Populations And Endangered Ecological Communities*.

Those undertaking works in areas where threatened species occur are advised to apply for a Section 132C licence (Application for a scientific licence for the purpose of science, education or conservation) under the NPW Act. They should also complete the NSW NPWS Checklist For Bush Regeneration Activities In The Habitat Of Threatened Species, Endangered Populations And Endangered Ecological Communities.

A section 132C licence is issued where the NPWS considers that the proposed work is for conservation purposes. Issuing of licences is generally on an annual basis. However, shorter or longer term licences are also issued where appropriate.

Threatened species, endangered populations and endangered ecological communities are protected in NSW under the *Threatened Species Conservation Act 1995* (TSC Act). It is an offence to “harm” or “pick” threatened species, populations or ecological communities.

Areas where bush regeneration is undertaken are often the habitat of threatened species. It is understood that the intention of bush regeneration activities is to have a positive impact, however, there is a chance that these activities may adversely impact on threatened species, populations or ecological communities.

The Bush Regeneration Checklist is intended to ensure that bush regeneration activities will not have a significant impact on threatened species, populations or ecological communities and their habitats. It is suggested that the standard checklist

be attached to the Section 132C licence application to assist the NPWS in assessing the significance of the proposed activity. It is assumed by NPWS that the applicant will adhere to the guidelines in the checklist where they form part of the licence application. Detail of any proposed work additional or contrary to that described in the checklist must be provided. The NSW NPWS then assesses the likely significance if the impact of the proposal using the information provided in the licence application.

For the purpose of the checklist, bush regeneration is considered as all types of habitat restoration and may include such activities as manual weed removal, herbicide use, temporary damage to, or removal of native plants, planting, track work or maintenance and habitat removal or modification.

Information is provided in the checklist on management planning, training and supervision, access to sites, impacts on flora, impacts on fauna, reconstruction through revegetation, herbicide use, reporting and data records.

Table 2: Threatened Flora Species of Ballina Shire Coastal Areas

FAMILY CODE	SPECIES	COMMON NAME	TSCA	ROTAP	FORM	HABITAT	LOCATION Site numbers	LOCATIONS (other)
LAURACEAE	<i>Cryptocarya foetida</i>	Stinking Cyrtocarya	V	3VCi	tree	littoral rainforest	1, 3, 6, 10, 19, 23	North from Iluka, Q
RUTACEAE	<i>Acronychia littoralis</i>	Scented Acronychia	E	3ECi	tree	littoral rainforest and coastal areas	10	Iluka to Kingscliff
AGAVACEAE	<i>Cordyline congesta</i>	Toothed Palm-lily	n/a	2RC-	shrub	In and on the margins of warmer rainforest on coastal lowlands	3, 10, 19, 20	North of the Clarence River
ORCHIDACEAE	<i>Acianthus amplexicaulis</i>	Mosquito Orchid		3RC-	orchid	Variety of habitats including coastal sand	Identified by herbarium but precise location iwas not recorded.	Lamington NP, Broken Head NR, Bundjalung NP, Dorrigo NP, Yuragyr NP
LAMIACEAE	<i>Plectranthus cremnus</i>	Plectranthus	n/a	3K	herb	coastal headlands	Identified by herbarium but precise location iwas not recorded.	Lennox Head to Kendall district
MIMOSACEAE	<i>Archidendron hendersonii</i>	Laceflower	V	n/a	tree	Variety of habitats including coastal sand	6, 10	From North Qld. To the Richmond River

*Threatened Species Conservation Act (TSCA) V = vulnerable, E = endangered

*TSCA and ROTAP codes are detailed in Appendix 7.

5.3 Other Issues

5.3.1 Fauna

Threatened fauna species that have been recorded at this site include:
The Sooty Oystercatcher, Pied Oystercatcher, Osprey, Little Tern.

The Osprey (*Pandion haliaetus*), which is listed as vulnerable, Schedule 2, on the NSW *Threatened Species Conservation Act 1995*, is occasionally seen hunting off shore. Ospreys forage for fish in fresh, brackish or saline water of rivers, lakes, estuaries and inshore coastal waters. A breeding pair requires a suitable foraging area with nesting sites nearby (NPWS,2002). Threats to the existence of the Osprey as listed by the NPWS, 2002 include:

- Loss of existing and replacement nest trees.
- Disturbance at the nest site resulting in reduced breeding success.
- Reduction in quality or quantity of fish stocks.
- Entanglement in discarded fishing line and other refuse.
- Collision with or electrocution by power lines.
- Effects of pesticides.

Birds can be useful surrogates or indicators of biodiversity. Monitoring of birds can provide information on the distribution of diversity and signal changes to ecosystems. Importantly, birds – often noisy, colourful and active during the day, are relatively easy to observe, which make monitoring accessible, unobtrusive, cost efficient and, not least enjoyable (Olsen Weston, Cunningham and Silcocks, 2003)

Extension and enhancement of the littoral rainforest would provide habitat for threatened fruit eating species such as the Superb Fruit-dove (*Ptilinopus superbus*) and Rose-crowned Fruit-dove (*Ptilinopus regina*). Threatened nectar eating fauna that would benefit from habitat extension of all vegetation types include the Regent Honeyeater (*Xanthomyza phrygia*) and Common Blossom-bat (*Syconycteris australis*). The Black (*Pteropus alecto*) and Grey-headed Flying Fox survive on a diet of fruit and nectar and aid the spread of seeds and the pollination of native flowers. The presence of these vulnerable species will aid natural regeneration.

Snakes, ticks, ants, mosquitoes and chiggers (the larval mites that cause “scrub itch”) can potentially cause discomfort, disease and serious illness. The best way to avoid complications is to minimise the risk of bites. Always wear protective clothing i.e. long sleeves and trousers tucked into sturdy boots, socks and a hat. Apply repellent (particularly pyrethrins/DEET/triclosan antiseptics) to skin and clothing, and always take repellent and a comprehensive first aid kit into the field. Lignocaine gel can give localized relief from bites. Ticks should be killed before removal as the shock of physical removal can stimulate them to release more toxin into their host.



Plate 32: Land Mullet (*Tiliqua scincoids*)

5.3.2 Signage

“Most signage is used to enhance public safety, to control undesirable behaviour or to educate the community by raising awareness and understanding. Unnecessary signage is poor signage”. (Kidd, R. 2001).

Signage can be a useful way to advertise stewardship of an area and to guide behaviour. It can also be used to raise awareness of issues and to interpret interesting natural features. Signs should be durable and aesthetically in keeping with the surrounds in which they will be positioned. Messages should be positive and ideally give reasons why an activity is undesirable for an area, for example: *Erosion prone area under repair please do not enter* rather than *Keep Out!*

A Dunecare group may start off with one sign advertising the group but be aware that different sponsoring agencies and labour market programs may also want to advertise their involvement. For this reason, placement of the initial sign should be assessed for its ability to “carry” a number of others without becoming an eyesore.

Many different materials and styles are available for signs. For those placed permanently, they need to be robust, durable and attractive. Hardwood signs with routed lettering used by NPWS best meet this criteria.

For temporary signs such as might be used to advertise working bees, spray activities or temporary track closures, lightweight polyflute signs with laser-cut lettering are the most appropriate. These are available from your local sign writer.

Further information on signs is available in the following publications.

Kidd, R. 2001. *Coastal Dune Management*. NSW Dept of Land and Water Conservation.

NPWS. (nd). *Signage Design Standards*. NSW National Parks and Wildlife Service, Sydney.

Gorrell, S. (nd). *Walking track construction guidelines*. NSW National Parks and Wildlife Service, Sydney.

5.3.3 Community Education

Swimmers, walkers, locals and visitors frequently visit Angels Beach and Black Head. Regeneration workers can provide important community education by explaining the value of the work being conducted.

5.3.4 Rubbish Dumping

Dumping of rubbish and garden waste is a problem in most natural areas. It is also one of the main ways that exotic plants are introduced in vegetation remnants. Explanatory signage and personal communication with anyone observed dumping may discourage the practice, and always remove any rubbish found when working.

5.3.5 Dogs

Angels Beach is part of a designated dog exercise area in Ballina Shire. Designated areas are as follows:

- Sharpes Beach, east Ballina (north of Flat Rock) Leash required
- Angels Beach, East Ballina (south of Flat Rock) Leash required
- Tressles Beach (Black Head), East Ballina (south of Flat Rock) Leash required

Owners are responsible for picking up dog faeces and disposing of the waste in a hygienic manner. When the dog is unleashed, the accompanying person must carry the leash and dog owners and carers must be in attendance and in control of their dogs at all times.

5.3.6 Dune Reconstruction and Protection

Beach erosion is a natural and dynamic process that is often hastened by misuse of the dunes. Beach users can cause erosion by developing informal tracks or sliding down and digging into dune scarps. If an area is obviously being used in this manner, it may be worth fencing or brush matting the spot to discourage the practice. Explanatory signage may also prove useful. Areas where blowouts are developing will require rehabilitation works.

The following information has been summarised from NSW Department of Land and Water Conservation, 2001. *Coastal Dune Management: A Manual of Coastal Dune Management and Rehabilitation Techniques*. For further details on this topic and specific designs for a range of fences and pathways, refer to this manual.

The aim of dune rehabilitation is to endeavor to establish a landscape that resembles, as closely as practical, the dunes that were present before the degradation began. At some sites, erosion or other damage may have been so severe that the first task is to reshape the sand mass into a landform that might have been expected to develop naturally. At other sites the dunes may not have suffered erosion and degradation may be limited to invasion by weeds. Variation in visitation levels effects the type of control structures that may be needed; this includes fencing, accessways and signage.

Dune forming fences

The principal function of a dune-forming fence is to reduce the wind velocity, thereby causing drift sand to be deposited in the vicinity of the fence. This technique can be used for small blowouts, larger scale dune formation and at sites where it is not feasible to import new material. Dune forming fences are most commonly made of a porous material such as a woven synthetic cloth. This material is attached to plain wire strained between treated pine posts. Accumulated sand may require revegetation to assist in the stabilization process. An example of a dune forming from Kidd (2001) fence can be seen in **Appendix 12**.

Protective fencing

Dune vegetation is particularly susceptible to damage from pedestrian and vehicular traffic. Fences are therefore used in the dune areas to preserve both revegetated and naturally vegetated areas. In severe cases two major fence lines are recommended, one along the seaward margin of the dune field, and another landward fence that protects hind dune areas. Designated pathways provide controlled access for beach users to cross the dune and these should be fenced. All accessways require regular maintenance so that they continue to function correctly and do not become a hazard to the public. Pruning of the overhanging vegetation should be subtly performed using directional pruning techniques.

5.3.7 The intertidal zone (rocky shelf)

The Angels Beach site contains many ecosystems and habitat types. Ecosystems that are overlooked when planning management strategies for the coastal strip are those on the intertidal zone. Flat Rock is an example of a separate ecosystem, a rock platform, offering a diversity of species and requiring consideration in the overall plan.

Rocky intertidal habitats form a rich food source for fish that come in to feed at high tide and for a wide range of birds that feed at low tide. These grazers and predators may have an important influence on the biota of the shore.

While it is reassuring to feel this is a weed free zone, it is still a complex ecosystem with differing ecological relationships at play and a definite set of parameters determining what species can exist. Issues of wave action and desiccation need to be considered when looking at species that would inhabit this zone.

Many of the events that will affect life on the rock shelf are beyond our control, these include tidal fluctuations, large waves physically scouring the rocks and sand deposits smothering organisms. These are natural occurrences and the system should recover in time. In contrast inappropriate human activity can have long-term impacts. These impacts can include introduced exotic marine organisms, oil spills, contamination via storm water and effluent flows, excessive foot traffic, shell collecting and unsustainable bait or food gathering.

Indicators of environmental health (on rocky shelves) are not well documented and are explained in terms such as “species diversity”. Given the lack of useful indicators, it is a persuasive argument to maintain conservation values by restricting shoreline activities as much as possible, in the hope that, if interference is minimal, a habitat will be maintained in a “natural” condition. Holmes (2000) suggests this approach has the advantage that the management for conservation is obvious to the human community, but carries the disadvantage that it may require the prohibition of traditional activities that people value, leading to possible public reaction to intertidal management.

Flat Rock has undergone many changes in the past 40 years. Species diversity has decreased and the health of the platform is in decline. This situation has been exacerbated by increased usage resulting from the construction of the Coast Road. (Reid, pers comm.)

5.4 General Management Recommendations

- Angels Beach Dunecare and Reafforestation Group Inc. and the Beachfront Parade Dunecare Group should continue to apply for assistance from Work for the Dole teams and/or Green Corps teams. However, care should be taken to allocate tasks to volunteers that are appropriate to the participants' level of skill.
- Frequent liaison with Ballina Shire Council should also be maintained so that council management and staff are familiar with the progress of works at Angels Beach and to enable the provision of Council assistance where possible.
- A brochure or flyer circulated to residents and the local schools may encourage increased volunteer participation and discourage the planting of environmental weeds in local gardens. Education could be aimed at reducing destructive foredune activities such as using informal access tracks and camping in the dunes.
- Ballina Shire Council to implement a bush regeneration program utilising Council staff or contractors. The program would provide ongoing assistance to community groups particularly with highly specialised activities such as spot spraying.

5.4.1 Boardwalk maintenance

All board and chain constructions should be lifted at least annually. Ballina Shire Council has agreed to manage this task (White pers com, 2004).

“In areas where sand is accumulating, board and chain accessways require regular lifting so that the boards sit on the sand surface. If this is not done the boards can become so deeply buried that recovery without disturbing adjacent vegetation is extremely difficult and time consuming. In some situations deeply buried boards cannot be easily recovered, thereby requiring complete replacement of the boards and chain. This replacement is an expensive operation and can be avoided by regular maintenance. Board and chain with broken, splintered or undermined boards require urgent repair as they can injure pedestrians and damage vehicles.” (Kidd, 2001)

5.4.2 Monitoring

It is important to monitor all projects by using “before and after” photography. This provides a record of progress that will prove beneficial when applying for further funding and to identify successful techniques. Photos will serve to reassure volunteers that their work has been rewarding. The product of rehabilitation works is best seen when specific photo points are established during the initial stages of the project and continually used.

Photo points should be identified with a permanent marker (a stake or picket) and the exact location used for each photo shooting in the same direction. This can be established by referring to past photos before taking each photo. Photographic records should be updated at least seasonally (i.e. three to six monthly) and after major events, such as a big plantings, storm or fire.

Records of working bees, including attendance, activities undertaken, weather constraints, successes and failures etc. are also invaluable monitoring tools. An example of a work record sheet is included as **Appendix 11**.

Another important aspect of monitoring is maintaining species lists. The flora and weed lists in this plan (Appendices 1 and 2) should be continually updated as new species are recorded. It is also useful to expand the fauna species list for the site, particularly as the site provides habitat for a threatened species (the Little Tern and Osprey). This information should be shared with land managers such as Ballina Shire Council, the Department of Infrastructure, Planning and Natural Resources and the Department of Environment and Conservation, Park Service Division (formerly NSW NPWS)

The management strategies and actions detailed in this plan are intended to provide a basis for the successful establishment of local native plant communities resembling those existing on the site prior to European settlement. It is important the plan implementation takes into consideration changing site conditions. Regular monitoring will provide feedback on the success or failure of management strategies and allow adaptation of the rehabilitation techniques and implementation schedule to achieve maximum effectiveness in weed control, dune stability and successful revegetation (James, 2000).

CONCLUSION

Ballina Shire Council initiation of this plan demonstrates support for the provision of sustainable and appropriate bush regeneration and coastal land management principles in the area. The plan aims to improve habitat for wildlife, conserve threatened species and forest types, reduce erosion, improve public amenity, and encourage wider community interest and participation in managing the coastal environment. This plan is a part of Precinct Plan 4, part of the Ballina Coastal Reserve Plan of Management.

The Angels Beach site is a model of what can be achieved through the commitment and involvement of the community working in conjunction with local council. Ongoing work using the recommendations in this document will ensure sustainable management of this dynamic stretch of coastline. The plan provides strategies, methods and a prioritised work program for restoration of coastal dune vegetation at Angels Beach. The guidelines, compiled in consultation with Dunecare groups, incorporate current best practice in ecological restoration.

Weed infestation, fire, sand mining and quarrying have created an altered environment in need of protection and remediation. The key players aim to restore the existing vegetation structure of the twenty three sites back to, or as close as possible to, its original form.

The native vegetation at Angels Beach and Black Head is valuable in environmental, social, recreational and economic terms. Sustainable management will provide benefits to those who enjoy this scenic area of coastline into the future.

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Appendix 1: Native Plant Species List Angels Beach

Native Flora species of East Ballina between Sharpes Creek (Flat Rock) and Black Head

= planted Column "0" Refers to species identified by the herbarium but whose precise location is currently uncertain.

Trees and Shrubs

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Mimosaceae	<i>Acacia binervia</i>	Coast Myall		*														*								
Mimosaceae	<i>Acacia longifolia</i>	Sydney Golden Wattle	*																							
Mimosaceae	<i>Acacia melanoxylon</i>	Sally Wattle (Blackwood)		*									*				*				*	*	*			
Mimosaceae	<i>Acacia longissima</i>	WA Wattle	*																							
Mimosaceae	<i>Acacia sophorae</i>	Coastal Wattle		*	*	*	*	*		*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*
Mimosaceae	<i>Acacia suaveolens</i>	Sweet Wattle								*	*	*										*	*	*	*	
Mimosaceae	<i>Acacia ulicifolia</i>	Prickly Wattle								*	*	*	*		*		*	*	*					*		
Myrtaceae	<i>Acmena hemilampra</i>	Broad-leaved Lilly Pilly		*														*	*	*	*	*	*	*	*	
Myrtaceae	<i>Acmena ingens</i> #	Red Apple	*																							
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly		*		*							*					*	*	*	*	*	*	*	*	
Myrtaceae	<i>Acmena smithii var. minor</i>	Lilly Pilly											*													
Rutaceae	<i>Acronychia imperforata</i>	Beach Acronychia		*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Rutaceae	<i>Acronychia littoralis</i>	Scented Acronychia											*													
Rutaceae	<i>Acronychia wilcoxiana</i>	Lemon Aspen		*																						
Simaroubaceae	<i>Ailanthus tryphysa</i>	White bean													*					*			*			
Sapindaceae	<i>Alectryon coriaceus</i>	Beach Birdseye		*		*			*		*		*				*			*	*	*	*	*	*	*
Casuarinaceae	<i>Allocasuarina equisetifolia</i>	Horsetail Sheoak						*								*							*	*		
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black Sheoak	*							*	*						*		*	*	*	*	*	*	*	*
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash		*									*		*				*	*						

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	
Apocynaceae	<i>Alyxia ruscifolia</i>	Chain Fruit																					*				
Araucariaceae	<i>Araucaria cunninghamii</i>	Hoop Pine		*																							
Mimosaceae	<i>Archidendron hendersonii</i>	White Lace Flower							*				*														
Araceae	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm			*	*							*									*					
Sapindaceae	<i>Arytera divaricata</i>	Coogera							*				*			*							*				
Myrtaceae	<i>Austromyrtus dulcis</i>	Midgen berry		*		*				*	*	*	*		*		*	*	*	*	*	*	*	*	*	*	
Myrtaceae	<i>Backhousia myrtifolia</i>	Grey Myrtle	*																		*						
Myrtaceae	<i>Baekkea stenophylla</i>	Weeping Coast Myrtle	*																				*				
Proteaceae	<i>Banksia aemula</i>	Wallum Banksia										*															
Proteaceae	<i>Banksia integrifolia</i>	Coast Banksia		*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Proteaceae	<i>Banksia serrata</i>	Saw/Old Man Banksia				*				*	*	*	*	*	*	*	*										
Sterculiaceae	<i>Brachychiton acerifolius</i> #	Flame Tree																					*				
Euphorbiaceae	<i>Breynia oblongifolia</i>	Breynia		*		*	*						*	*	*		*	*	*	*	*	*	*	*	*	*	
Myrtaceae	<i>Callistemon pachyphyllus</i>	Swamp Bottlebrush	*																								
Myrtaceae	<i>Callistemon salignus</i>	White Bottlebrush											*										*				
Cupressaceae	<i>Callitris columellaris</i>	White (Coast) Cypress		*						*	*	*	*		*		*	*	*	*	*	*	*	*	*	*	
Rubiaceae	<i>Canthium coprosmoides</i>	Coast Canthium											*														
Celastraceae	<i>Cassine australis</i>	Red Olive Plum																*					*				
Casuarinaceae	<i>Casuarina glauca</i>	Swamp She-oak	*																								
Euphorbiaceae	<i>Claoxylon australe</i>	Brittlewood	*																								
Verbenaceae	<i>Clerodendrum floribundum</i>	Smooth Clerodendrum				*							*										*		*		
Verbenaceae	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	*																								
Sterculiaceae	<i>Commersonia bartramia</i>	Brown Kurrajong		*						*	*	*	*					*	*	*	*	*				*	
Agavaceae	<i>Cordyline congesta</i>	Toothed Palm-Lily				*							*										*	*			
Agavaceae	<i>Cordyline petiolaris</i>	Broad-leaf Palm Lily																					*				
Agavaceae	<i>Cordyline stricta</i>	Slender Palm Lily		*																		*					
Myrtaceae	<i>Corymbia intermedia</i>	Pink Bloodwood				*	*		*	*	*	*	*		*		*	*	*	*	*	*				*	

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Lauraceae	<i>Cryptocarya foetida</i>	Stinking Cryptocarya		*		*			*				*								*				*	
Lauraceae	<i>Cryptocarya glaucescens</i>	Jackwood											*													
Lauraceae	<i>Cryptocarya triplinervis</i>	Three Vein Laurel		*		*	*		*			*	*		*	*	*		*	*	*	*		*	*	
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo		*		*	*		*			*	*		*	*	*	*	*	*	*	*	*	*	*	
Myrtaceae	<i>Decaspermum humile</i>	Silky Myrtle	*																							
Celastraceae	<i>Denhamia celastroides</i>	Orange Boxwood											*								*	*				
Fabaceae	<i>Dillwynia retorta</i>	Eggs & Bacon	*									*										*				
Ebenaceae	<i>Diosporus fasciculosa</i>	Grey Ebony		*								*									*					
Sapindaceae	<i>Diploglottis australis</i>	Native Tamarind	*																							
Sapindaceae	<i>Dodonea triquetra</i>	Hop Bush				*				*	*				*						*	*				
Euphorbiaceae	<i>Duboisia myoporoides</i>	Soft Corkwood		*		*	*		*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Elaeocarpaceae	<i>Elaeocarpus obovatus</i>	Hard Quandong		*								*										*				
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash		*		*						*				*					*	*			*	
Lauraceae	<i>Endiandra muelleri</i> ssp. <i>bracteata</i>	Green-leaved Rose Walnut	*																							
Lauraceae	<i>Endiandra pubens</i>	Hairy Walnut	*																							
Lauraceae	<i>Endiandra muelleri</i>		*																							
Lauraceae	<i>Endiandra seiberi</i>	Hard Corkwood				*			*			*						*								
Epacridaceae	<i>Epacris pulchella</i>	Wallum Heath																				*				
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany													*					*					*	
Myrtaceae	<i>Eucalyptus signata</i>	Scribbly Gum	*																							
Eupomatiaceae	<i>Eupomatia laurina</i>	Bolwarra		*		*			*		*	*						*				*				
Santalaceae	<i>Exocarpus latifolius</i>	Bush Ballart		*		*						*			*									*		
Moraceae	<i>Ficus coronata</i>	Sandpaper Fig		*					*		*	*		*			*							*		
Moraceae	<i>Ficus obliqua</i>	Small-leaved Fig							*																	
Moraceae	<i>Ficus watkinsiana</i>	Strangling Fig				*			*			*											*			

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Rutaceae	<i>Flindersia bennettiana</i>	Bennetts Ash		*		*							*													
Rutaceae	<i>Flindersia schottiana</i>	Cudgerie											*										*			
Euphorbiaceae	<i>Glochidion ferdinandi</i>	Cheese Tree											*										*	*		
Euphorbiaceae	<i>Glochidion sumatranum</i>	Umbrella Cheese tree		*	*	*							*	*		*			*	*	*	*	*	*	*	
Verbenaceae	<i>Gmelina leichardtii</i>	White Beech																		*						
Sapindaceae	<i>Guioa semiglauca</i>	Guioa		*								*	*			*						*	*			
Sapindaceae	<i>Harpullia pendula</i>	Tulip Wood	*																							
Celastraceae	<i>Hedraianthera porphyropetala</i>	Hedraianthera		*																						
Dilleniaceae	<i>Hibbertia obtusifolia</i>																						*			
Myrtaceae	<i>Homoranthus virgatus</i>	Coast Honey Myrtle																					*			
Sapindaceae	<i>Jagera pseudorhus</i>	Foambark											*													
Myrtaceae	<i>Leptospermum trinervium</i>	Paperbark Tea Tree (Victorian)								*	*	*														
Epacridaceae	<i>Leucopogon ericoides</i>	White Beard																					*			
Epacridaceae	<i>Leucopogon leptospermoides</i>																						*			
Epacridaceae	<i>Leucopogon parviflorus</i>	Coastal Beard Heath								*	*												*	*		
Lauraceae	<i>Litsea leefeana</i>	Brown Bolly Gum											*													
Arecaceae	<i>Livistonia australis</i> #	Cabbage Palm	*																							
Myrtaceae	<i>Lophostemon confertus</i>	Brushbox		*		*			*	*	*	*	*		*				*	*	*	*	*	*		*
Myrtaceae	<i>Lophostemon suaveolens</i>	Swamp Box											*													
Euphorbiaceae	<i>Macaranga tanarius</i>	Macaranga		*									*		*	*					*					*
Euphorbiaceae	<i>Mallotus discolor</i>	White Kamala		*								*	*	*											*	
Euphorbiaceae	<i>Mallotus philippensis</i>	Red Kamala										*	*										*			
Celastraceae	<i>Maytenus disperma</i>	Orange Bush																			*					
Myrtaceae	<i>Melaleuca armillaris</i>	Giant Honey Myrtle																						*		
Myrtaceae	<i>Melaleuca quinquenervia</i>	Paperbark		*	*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Melastomaceae	<i>Melastoma affine</i>	Blue Tongue															*				*	*				
Rutaceae	<i>Melicope elleryana</i>	Pink Euodia										*	*									*	*			

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Rutaceae	<i>Melicope octandra</i>	Doughwood	*																							
Sapindaceae	<i>Mischocarpus australis</i>	Pear Fruit											*										*			
Sapindaceae	<i>Mischocarpus pyriformis</i>	Yellow Pear Fruit											*													
Epacridaceae	<i>Monotoca elliptica</i>	Tall Broom Heath		*			*	*		*	*	*			*		*	*	*	*	*	*	*	*	*	
Myoperaceae	<i>Myoporum boninense</i>	Coastal Boobialla							*				*													
Lauraceae	<i>Neolitsea australiensis</i>	Green Bolly Gum											*	*												
Lauraceae	<i>Neolitsea dealbata</i> #	White Bolly Gum	*																							
Oleaceae	<i>Notalaea longifolia</i>	Veinless Mock Olive		*									*		*						*					
Euphorbiaceae	<i>Omalanthus populifolius</i>	Bleeding Heart		*														*	*	*	*					
Fabaceae	<i>Oxylobium robustum</i>	Golden Shaggy Pea				*							*													
Pandanaceae	<i>Pandanus tectorius</i>	Pandanus		*		*	*						*				*			*	*		*			
Proteaceae	<i>Persoonia adenantha</i>	Geebung		*		*			*	*	*	*		*	*						*	*				
Proteaceae	<i>Persoonia stradbrokeensis</i>	Geebung		*		*			*	*	*	*		*	*						*	*		*		
Proteaceae	<i>Persoonia virgata (not linearis)</i>	Narrow-leaved Geebung																				*				
Rutaceae	<i>Phebalium squameum</i>	Satinwood										*			*							*				
Euphorbiaceae	<i>Phyllanthus virgatus</i> #		*																							
Fabaceae	<i>Phyllota phyllicoides</i>																						*			
Thymeliaceae	<i>Pimelia glauca</i>	Smooth Rice Flower																				*				
Thymeliaceae	<i>Pimelia linifolia</i>	Rice Flower							*									*				*	*	*		
Pittosporaceae	<i>Pittosporum multiflorus (ex Citrobatus)</i>	Orange Thorn	*																							
Pittosporaceae	<i>Pittosporum revolutum</i>	Hairy Pittosporum											*			*						*	*	*		
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum		*		*			*				*									*	*			
Podocarpaceae	<i>Podocarpus elatus</i>	Plum Pine		*		*			*													*	*			
Araliaceae	<i>Polyscias elegans</i>	Celerywood		*		*			*		*	*	*					*				*	*	*	*	
Myrsinaceae	<i>Rapanea howitteana</i>	Brush Muttonwood				*																				
Myrsinaceae	<i>Rapanea variabilis</i>	Variable Muttonwood		*		*			*		*	*						*			*	*	*	*	*	

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Myrtaceae	<i>Rhodamnia argentea</i> #	Silver Myrtle	*																							
Myrtaceae	<i>Rhodomyrtus psidiodes</i>	Native Guava				*													*	*	*	*				
Anacardiaceae	<i>Rhodospaera rhodantha</i> #	Deep Yellow-Wood	*																							
Euphorbiaceae	<i>Ricinocarpos pinifolius</i>	Wedding Bush								*	*	*								*		*	*	*	*	*
Sapindaceae	<i>Sarcopteryx stipata</i> #	Steelwood	*																							
Celastraceae	<i>Siphonodon australe</i>	Ivory Wood							*																	
Sterculiaceae	<i>Sterculia quadrifida</i> #	Peanut Tree																					*			
Epacridaceae	<i>Styphelia viridens</i>	Five corner fruit								*	*	*											*			
Meliaceae	<i>Synoum glandulosum</i> #	Scentless Rosewood	*																							
Myrtaceae	<i>Syzygium australe</i>	Brush Cherry																				*	*			
Myrtaceae	<i>Syzygium francisii</i> #	Giant Water Gum	*																							
Myrtaceae	<i>Syzygium leuhmannii</i> #	Riberry	*																			*				
Myrtaceae	<i>Syzygium oleosum</i>	Blue Lilly Pilly		*		*				*			*							*		*	*	*	*	*
Myrtaceae	<i>Thryptomene parviflora</i>																						*			
Meliaceae	<i>Toona ciliata</i>	Red Cedar											*													
Ulmaceae	<i>Trema tomentosa viridis</i>	Poison Peach		*		*	*	*					*		*	*				*	*	*	*	*	*	*
Epacridaceae	<i>Trochocarpa laurina</i>	Tree Heath								*		*														
Thymeleaceae	<i>Wikstroemia indica</i>	Bushmans Boot Lace		*					*				*		*	*			*		*	*	*	*	*	*
Monimeaceae	<i>Wilkiea austroqueenslandica</i> #	Smooth Wilkiea	*																							
Monimeaceae	<i>Wilkiea huegeliana</i> #	Veiny Wilkiea	*																							
Rutaceae	<i>Zieria laevigata</i>	Lanoline Bush				*				*			*		*				*				*		*	*
TREES & SHRUBS BIODIVERSITY TOTAL			27	47	5	37	11	6	17	30	20	32	66	14	26	3	25	20	26	29	27	42	68	12	35	23

Vines

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Loranthaceae	<i>Amylotheca dictyophleba</i>	Brush Mistletoe											*		*		*	*	*	*	*	*	*		*	*
Arecaceae	<i>Calamus muelleri</i>	Lawyer Vine		*		*																				
Fabaceae	<i>Canavalia rosea</i>	Beach Bean		*			*	*										*				*	*	*		
Vitaceae	<i>Cayratia clematidea</i>	Slender Grape		*		*	*	*					*		*		*		*						*	
Vitaceae	<i>Cissus antarctica</i>	Water Vine				*							*			*										
Vitaceae	<i>Cissus hypoglauca</i>	Five-leaf Water Vine				*																	*			
Dioscoreaceae	<i>Dioscorea transversa</i>	Native Yam											*													
Cucurbitaceae	<i>Diplocyclos palmatus</i>	Striped Cucumber		*		*	*	*					*				*	*	*	*	*	*	*		*	*
Philesiaceae	<i>Eustrephus latifolius</i>	Wombat Berry				*																				
Flagellariaceae	<i>Flagellaria indica</i>	Whip Vine			*				*				*													
Philesiaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily		*		*			*	*			*				*	*	*	*	*	*	*		*	*
Fabaceae	<i>Glycine clandestina</i>	Glycine		*		*	*	*	*	*			*		*		*	*	*	*	*	*	*		*	*
Fabaceae	<i>Glycine tabacina</i>	Glycine	*																							
Fabaceae	<i>Hardenbergia violaceae</i>									*		*												*		
Dilleniaceae	<i>Hibbertia scandens</i>	Guinea Flower		*	*		*	*	*	*			*	*	*		*	*	*	*	*	*	*	*	*	*
Asclepiadaceae	<i>Hoya oligotricha (ex australis)</i>	Wax Flower		*		*	*																			
Convolvulaceae	<i>Ipomoea pes-caprae</i>	Goats Foot		*		*	*	*							*		*	*				*		*		
Fabaceae	<i>Kennedia rubicunda</i>	Dusky Coral Pea								*	*	*					*	*			*	*				*
Pteridophyta	<i>Lygodium microphyllum</i>	Climbing Fern		*	*	*							*	*												
Moraceae	<i>Maclura cochinchinensis</i>	Cockspur				*										*										
Asclepiadaceae	<i>Marsdenia rostrata</i>	Common Milk Vine				*				*															*	
Asclepiadaceae	<i>Marsdenia viridiflora</i>	Native Pear	*																							
Fabaceae	<i>Mucuna gigantea</i>	Burny Bean		*																						
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Vine			*					*		*	*	*		*	*		*	*	*	*	*		*	*
Apocynaceae	<i>Parsonsia straminea</i>	Common Silk Pod		*	*							*	*	*	*										*	
Passifloraceae	<i>Passiflora aurantia</i>	Native Passionfruit				*	*																			

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Passifloraceae	<i>Passiflora herbertiana</i>	Native Passionfruit		*		*	*	*	*						*	*	*			*	*	*				
Smilacaceae	<i>Smilax australis</i>	Austral Sarsaparilla		*	*	*	*	*	*	*	*	*	*	*	*		*					*		*	*	*
Menispermaceae	<i>Stephania japonica</i>	Snake Vine		*					*		*	*	*				*				*	*	*	*	*	*
Fabaceae	<i>Vigna marina</i>	Yellow Beach Bean		*			*	*									*	*				*	*			
VINES BIODIVERSITY TOTAL			2	16	6	16	11	9	7	6	4	6	15	5	9	1	14	10	8	7	9	11	13	5	11	9

Grasses, Groundcovers & Ferns

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Adiantaceae	<i>Adiantum hispidulum</i>	Rough Maiden Hair		*									*		*							*				
Araceae	<i>Alocasia brisbanensis</i>	Cunjevoi		*																		*			*	
Zingiberaceae	<i>Alpinia caerulea</i>	Native Ginger		*		*							*													
Apiaceae	<i>Apium prostratum</i> ssp. <i>prostratum</i> var. <i>Filiforme</i>						*																*			
Aspleniaceae	<i>Asplenium australasicum</i>	Birdsnest Fern		*		*							*	*	*								*			
Cyperaceae	<i>Baumea juncea</i>	Twig Rush										*				*							*			
Blechnaceae	<i>Blechnum cartilagineum</i>	Gristle Fern																					*			
Blechnaceae	<i>Blechnum indicum</i>	Swamp Water Fern											*	*								*	*			
Asteraceae	<i>Bracteantha bracteata</i>	Golden Everlasting																					*			
Acanthaceae	<i>Brunoniella australis</i>																						*			
Brassicaceae	<i>Cakile edentula</i>	American Searocket		*			*	*										*					*			
Brassicaceae	<i>Cakile maritima</i>	European Searocket		*			*	*										*					*			
Cyperaceae	<i>Carex pumila</i>	Dune Sedge		*				*															*			
Aizoaceae	<i>Carpobrotus glaucescens</i>	Pigface		*			*	*										*			*	*				
Cyperaceae	<i>Caustis recurvata</i>	Old Mans Beard										*														
Apiaceae	<i>Centella asiatica</i>			*		*	*						*		*		*					*	*		*	*
Commelinaceae	<i>Commelina cyanea</i>	Commelina		*		*	*	*	*				*	*	*		*		*	*	*	*	*	*	*	*

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Liliaceae	<i>Crinum pedunculatum</i>	Swamp Lily															*	*				*		*		
Cyatheaceae	<i>Cyathea cooperi</i>	Straw Tree Fern																					*			
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass										*	*		*	*	*					*	*			
Cyperaceae	<i>Cyperus enervis</i>	A Sedge		*													*					*	*		*	
Cyperaceae	<i>Cyperus polystachyos</i>	A Sedge	*																							
Davalliaceae	<i>Davallia pyxidata</i>	Hares Foot Fern	*																				*			
Liliaceae	<i>Dianella caerulea</i>	Flax Lily		*						*	*	*				*	*		*		*	*	*		*	
Liliaceae	<i>Dianella congesta</i>	Coastal Flax Lily					*	*							*								*			
Liliaceae	<i>Dianella crinoides</i>																						*			
Poaceae	<i>Dichelachne crinata</i>	Long Hair Plume Grass	*																							
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed					*																			
Poaceae	<i>Eragrostis elongata</i>	Clustered Love Grass																					*			
Poaceae	<i>Eragrostis interrupta</i>	Blue Love Grass		*				*				*	*	*								*	*	*		*
Cyperaceae	<i>Gahnia aspera</i>	Red-Fruited Saw Sedge										*											*			
Cyperaceae	<i>Gahnia clarkei</i>	Saw Sedge		*																		*	*			
Cyperaceae	<i>Gahnia sieberiana</i>	Saw Sedge		*																						
Asteraceae	<i>Helichrysum elatum</i>	Everlasting daisy																					*			
Dennstaedtiaceae	<i>Histiopterus incisa</i>	Batswing Fern		*																		*	*	*		
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	Harsh Ground Fern																			*		*			
Liliaceae	<i>Hypoxis hygrometrica</i>	Golden Weather-Grass																				*		*		
Poaceae	<i>Imperata cylindrica</i>	Blady Grass		*						*							*	*	*	*		*	*	*	*	*
Poaceae	<i>Ischaemum triticeum</i>																	*						*		
Cyperaceae	<i>Isolepis nodosa</i>	Knobby Club Rush		*			*	*										*	*	*	*		*	*		
Cyperaceae	<i>Lepironia articulata</i>								*			*	*													
Lindsaeaceae	<i>Lindsaea ensifolia</i> ssp. <i>agatii</i>		*																							
Lobeliaceae	<i>Lobelia alata</i>	Forest Lobelia				*																				
Lobeliaceae	<i>Lobelia trigonocaulis</i>	Forest Lobelia		*	*						*															

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Lomandraceae	<i>Lomandra filiformis</i>					*				*		*							*			*		*	*	
Lomandraceae	<i>Lomandra longifolia</i>	Mat Rush		*				*	*	*	*	*				*			*	*	*	*	*	*	*	
Asteraceae	<i>Melanthera biflora</i>			*	*																	*	*			
Commelinaceae	<i>Murdannia graminea</i>	Lawn Lily	*																							
Poaceae	<i>Oplismenus aemulus</i>	Basket Grass		*						*													*		*	
Poaceae	<i>Oplismenus imbecillis</i>	Basket Grass																					*			
Oxalidaceae	<i>Oxalis rubens</i>	Yellow Wood Sorrel		*		*										*						*				
Iridaceae	<i>Patersonia sericea</i>	Silky Purple Flag										*														
Adiantaceae	<i>Pellaea falcata</i>	Sickle Fern		*	*				*				*	*									*	*		
Polygonaceae	<i>Persicaria sp.</i>	Smart Weed							*																	
Poaceae	<i>Phragmites australis</i>	Native Reed		*					*													*	*	*		
Polypodiaceae	<i>Platynerium bifurcatum</i>	Elkhorn																					*			
Polypodiaceae	<i>Platynerium superbum</i>	Staghorn		*		*																	*			
Lamiaceae	<i>Platysace ericoides</i>																						*			
Lamiaceae	<i>Plectranthus cremnus</i>		*																							
Portulacaciae	<i>Portulaca pilosa</i>						*																			
Rubiaceae	<i>Pomax umbellata</i>								*	*		*	*	*									*		*	
Lobeliaceae	<i>Pratia purpurascens</i>	Forest Lobelia		*									*										*			
Acanthaceae	<i>Pseuderanthemum variabile</i>			*		*							*										*			
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken							*		*											*	*	*	*	
Polypodiaceae	<i>Pyrrosia rupestris</i>	Rock Felt Fern		*																			*			
Restionaceae	<i>Restio tetraphyllus</i>	A Cord Rush										*														
Rosaceae	<i>Rubus hillii</i>	Native Raspberry														*							*			
Schizaeaceae	<i>Schizaea bifida</i>	Forked Comb Fern										*														
Schizaceae	<i>Schizaea dichotoma</i>	Branched Comb-Fern	*																				*			
Aizoaceae	<i>Sesuvium portulacastrum</i>			*			*	*										*								
	<i>Sphagnum subsecundum</i>	Sphagnum Moss																					*			

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Poaceae	<i>Spinifex hirsutus</i>	Spinifex		*			*	*										*			*					
Poaceae	<i>Sporobolus virginicus</i>	Salt Water Couch													*		*						*			
Aizoaceae	<i>Tetragonia tetragonoides</i>	Warragul Spinach		*			*	*	*									*					*			
Tremandraceae	<i>Tetradlea thymifolia</i>	Black Eye Susan	*																							
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass					*			*		*							*		*	*	*	*	*	
Apiaceae	<i>Trachymene incisa</i>	Wild Parsnip																				*				
Anthericaceae	<i>Tricoryne elatior</i>		*																							
Uvulariaceae	<i>Tripladenia cunninghamii</i>	Kreysigia		*																						
Goodeniaceae	<i>Velleia spathulata</i>		*																							
Violaceae	<i>Viola hederacea</i>	Native Violet		*									*								*	*		*	*	
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian Bluebell		*		*	*	*	*				*		*		*	*	*	*	*	*	*	*	*	
Xanthorrhoeaceae	<i>Xanthorrhoea macronema</i>											*				*		*	*	*	*	*	*			
Poaceae	<i>Zoysia macrantha</i>																	*		*		*				
GRASSES GROUNDCOVERS & FERNS BIODIVERSITY TOTAL			10	35	2	11	15	13	8	8	0	14	16	6	7	2	12	15	6	9	9	22	50	19	11	10

Orchids

Family	Scientific name	Common name	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Orchidaceae	<i>Acianthus amplexicaulis</i>	Mosquito Orchid	*												?											
Orchidaceae	<i>Chierostylis ovata</i>												*													
Orchidaceae	<i>Chiloglottis diphylla</i>	Bird Orchid																				*				
Orchidaceae	<i>Microtis</i> sp.	Onion Orchid																				*				
Orchidaceae	<i>Pterostylis nutans</i>	Nodding Greenhood											*													
Orchidaceae	<i>Pterostylis ophioglossa</i>	Snake tongue Greenhood Orchid											*			*		*	*			*				
Orchidaceae	<i>Thelymitra</i> sp.	Sun Orchid																				*				
Orchidaceae	<i>Zeuxine oblonga</i>												*													
ORCHIDS BIODIVERSITY TOTAL			1	0	0	0	0	0	0	0	0	0	4	0	1	0	1	0	1	1	0	0	4	0	0	0

OVERALL BIODIVERSITY TOTAL (ALL NATIVE SPECIES)	40	98	13	64	37	28	32	44	24	52	101	25	43	6	52	45	41	46	45	75	135	36	57	42
OVERALL BIODIVERSITY RANKING (TOP 1-12 out of 23)		3		5				13		7	2		12		8	10		9	10	4	1		6	

Appendix 2: Weed (Exotic) Species List Angels Beach Planted

Exotic flora species

Family	Scientific name	Common name	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Basellaceae	<i>Anredera cordifolia</i>	Madeira Vine						*										*		*					
Asparagaceae	<i>Asparagus aethiopicus</i>	Ground Asparagus	*		*		*	*	*		*	*	*			*	*	*	*	*	*	*	*	*	*
Crassulaceae	<i>Bryophyllum delagoense</i>	Mother of Millions																		*					
Cannaceae	<i>Canna indica</i>	Canna Lily			*																				
Asteraceae	<i>Chrysanthemoides monilifera</i> ssp. <i>rotundata</i>	Bitou Bush	*	*		*	*		*	*	*		*	*		*	*	*		*	*	*	*	*	*
Lauraceae	<i>Cinnamomum camphora</i>	Camphor Laurel																				*			
Commelinaceae	<i>Commelina benghalensis</i>	Hairy Commelina																		*					*
Asteraceae	<i>Conzya albida</i>	Fleabane				*	*		*						*	*	*			*				*	
Fabaceae	<i>Erythrina crista-galli</i>	Cockscomb Coral Tree	*																	*					
Fabaceae	<i>Erythrina X sykesii</i>	Coral Tree																	*						
Euphorbiaceae	<i>Euphorbia cyathophora</i>	Painted Spurge														*			*	*				*	
Colchicaceae	<i>Gloriosa superba</i>	Glory Lily																	*						
Balsaminaceae	<i>Impatiens walleriana</i>	Impatiens																		*					
Convolvulaceae	<i>Ipomea cairica</i>	Coastal Morning Glory	*	*		*		*	*				*	*			*		*	*	*	*	*	*	*
Malvaceae	<i>Lagunaria patersonii</i>	Norfolk Island Hibiscus																							
Verbenaceae	<i>Lantana camara</i>	Lantana	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*		*		*		
Myrtaceae	<i>Leptospermum laevigatum</i>	Coastal Tea-Tree	*				*				*		*	*	*					*					
Mimosoideae	<i>Leucaena leucocephala</i>																			*					
Fabaceae	<i>Macropodium atropurpureum</i>	Siratro	*				*									*			*	*	*				
Poaceae	<i>Melinis minutifolia</i>	Molasses Grass				*	*													*			*		
Poaceae	<i>Melinis repens</i>	Red Natal Grass				*	*		*	*					*					*					*

Family	Scientific name	Common name	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
Rutaceae	<i>Murraya paniculata</i>	Orange Jessamine																							
Davalliaceae	<i>Nephrolepis cordifolia</i>	Fishbone Fern																			*				
Ochnaceae	<i>Ochna serrulata</i>	Mickey Mouse Bush	*																				*		
Onagraceae	<i>Oenantha drumondii</i>	Evening Primrose														*									
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear			*				*												*				
Passifloraceae	<i>Passiflora suberosa</i>	Corky Passionfruit														*					*			*	
Passifloraceae	<i>Passiflora subpeltata</i>	White Passionfruit	*		*	*						*	*					*							
Poaceae	<i>Pennisetum purpureum</i>	Bharna Grass						*																	
Phytolaccaceae	<i>Phytollaca octandra</i>	Ink Weed				*	*									*									
Pinaceae	<i>Pinus elliotii</i>	Slash Pine																							
Taenitidaceae	<i>Pityrogramma austroamericana</i> (naturalized)	Gold Fern																							
Portulacaceae	<i>Portulaca pilosa</i>	Ice Plant														*	*				*				
Myrtaceae	<i>Psidium guajava</i>	Guava																			*				
Rubiaceae	<i>Richardia brasiliensis</i>	White Eye														*									*
Phytolaccaceae	<i>Rivina humilis</i>	Coral Berry			*							*	*												
Dracaenaceae	<i>Sansevieria trifascita</i>	Mother- in- laws Tongue																						*	
Araliaceae	<i>Schefflera actinophylla</i>	Umbrella Tree	*	*	*			*	*		*	*												*	
Fabaceae	<i>Senna pendula</i> var. <i>glabrata</i>	Winter Senna	*									*	*	*		*		*		*		*		*	*
Solanaceae	<i>Solanum mauritanium</i>	Wild Tobacco	*			*	*					*												*	
Solanaceae	<i>Solanum nigrum</i>	Blackberry Nightshade	*			*	*								*	*				*		*	*	*	*
Solanaceae	<i>Solanum seaforthianum</i>	Climbing Nightshade				*	*					*			*				*	*	*		*		
Poaceae	<i>Stenotaphrum secundatum</i>	Buffalo Grass													*			*	*	*	*		*		*
Arecaceae	<i>Syagrus romanzoffianum</i>	Cocos Palm																			*				
Lamiaceae	<i>Westringia fruticosa</i> #	Westringia																		*					
Agavaceae	<i>Yucca americana</i>	Yucca																						*	

Appendix 3: Recommended Species for Revegetation

Vegetation Zonation

Where dune vegetation has not been disturbed significantly by human activity, distinctive plant zonation is routinely observed, irrespective of topographic differences. This plant zonation or succession reflects the progressively more sheltered environments that are created with increasing distance from the shoreline.

The various zones of dunes are vegetated by plants adapted to conditions in these zones. Typically there are three zones that grade into each other. These are;

- an unstable **incipient foredune** zone of colonising herbs and grasses
- a semi-stable **foredune** zone of shrubs and associated ground plants
- a stable **hind-dune** zone dominated by trees, with an understorey of shrubs and ground plants

(Department of Land and Water Conservation, 2001)

Incipient Dune	Fore Dune	Hind Dune
Beach Spinifex. <i>Spinifex sericeus</i> *Pig Face. <i>Carpobrotus glaucescens</i> *Goats Foot <i>Ipomoea pes-caprae</i> Beach Bean <i>Canavalia rosea</i> Dune Bean <i>Vigna marina</i> Knobby Club Rush <i>Isolepsis nodosa</i> Guinea Flower <i>Hibbertia scandens</i> Dune Dianella <i>Dianella congesta</i> * plants of cultural importance to the Arakwal people (Vidler et al, 2003, <i>Places of Plenty – Culturally Useful Plants around Byron Bay</i>)	Tree Broom Heath <i>Monotoca elliptica</i> Coastal Wattle <i>Acacia sophorae</i> Beach Beard Heath <i>Leucopogon parvifolius</i> , Black She-oak <i>Allocasuarina littoralis</i> *Coastal Banksia <i>Banksia integrifolia</i> *Wallum Banksia (<i>Banksia aemula</i>) <i>Banksia oblongifolia</i> *Midgen Berry <i>Austromyrtus dulcis</i> , Dune Dianella <i>Dianella congesta</i> Spiny Mat Rush <i>Lomandra longifolia</i>	Coast Banksia <i>Banksia integrifolia</i> Beach Birds-eye <i>Alectryon coriaceus</i> *Blue Lilly Pilly <i>Syzygium oleosum</i> Lilly Pilly <i>Acmena smithii</i> Broad Leaved Lilly Pilly <i>Acmena hemilampra</i> Bushmans Bootlace <i>Wikstroemia indica</i> Macaranga <i>Macaranga tanarius</i> Poison Peach <i>Trema aspera</i> Tuckeroo <i>Cupaniopsis anarcardioides</i> Celery Wood <i>Polyscias elegans</i> Beach Acronychia <i>Acronychia imperforata</i> Red Olive Plum <i>Cassine australis</i> Brushbox <i>Lophostemon confertus</i> Black She-oak <i>Allocasuarina littoralis</i> Cottonwood <i>Hibiscus tiliaceus</i> Native Guava <i>Rhodomyrtus psioides</i> *Pandanus <i>Pandanus tectorius</i> *Spiny Mat Rush <i>Lomandra longifolia</i>

Appendix 3b: Recommended Species for Revegetation in Zone 18
Species recommended for planting on the Hind dune. Beach Front Parade.

Botanic name	Common name
<i>Alectryon coriaceus</i>	Beach Birds Eye
<i>Cryptocarya triplinervis</i>	Three-veined laurel
<i>Austromyrtus dulcis</i>	Midgen Berry
<i>Acmena smithii</i>	Lilly Pilly
<i>Eupomatia laurina</i>	Bolwarra
<i>Lomandra longifolia</i>	Lomandra
<i>Trochocarpa laurina</i>	Tree Heath
<i>Cupaniopsis anacardioides</i>	Tuckeroo
<i>Acronychia imperforata</i>	Beach Acronychia
<i>Omalanthus populifolius</i>	Bleeding Heart
<i>Monotoca elliptica</i>	Broom Heath

Appendix 4: Weed Profiles

TREES AND SHRUBS

Agavaceae

Agave americana

Yucca

A native of Mexico. A very large perennial plant with a basal rosette of fleshy leaves up to 2 metres long with long spines along the margins. The plant was originally introduced as an ornamental and now occurs as a garden escapee in many parts of Australia. (Auld & Medd, 1992)

Araliaceae

Schefflera actinophylla

Umbrella Tree

Native of North Queensland and naturalised in coastal districts of northern NSW. A tree up to ten metres high, often multi-stemmed and sometimes epiphytic high in the canopy (Harden, 1992, p.87), making removal difficult. Birds disperse its red fruit. Adventitious roots form readily from stem segments that remain in contact with the ground.

Arecaceae

Syagrus romanzoffianum

Cocos Palm

Native of Brazil. A tall palm growing to 12 metres. Its fleshy fruit is dispersed by birds, rodents and water. Fruit is also eaten and dispersed by flying foxes (Eby and Palmer, 1988, 53). It is becoming a serious pest in Currie Park and Rotary Park, Lismore, NSW.

Asteraceae

Chrysanthemoides monilifera subsp. *rotundata*

Bitou Bush

Native of South Africa. An erect, shallow-rooted, densely branched perennial shrub up to three metres high (Auld and Medd, 1992). It grows on sand dunes and forest margins near beaches and poses a serious threat to native sand dune vegetation (Harden, 1992, p.315). These plants can invade and overwhelm all plant communities on the coastal system, growing in the open or in the shade of other plants. Up to 48,000 seeds per plant can be produced with a viability of up to seven years. Fruits are attractive to birds (Buchanan, 1989). There is increasing evidence that long-term domination of coastal frontal dunes by Bitou Bush leads to instability and increased erosion (Stanley et. al., 1989). It is a declared W3 noxious weed (i.e. must be prevented from spreading and its numbers reduced).

Caesalpinioideae

Senna pendula* var *glabrata

Winter Senna

Native of South America. A spreading shrub up to three metres high, it does not produce root nodules and is widely naturalized in coastal areas (Harden, 1991, p.319). It produces a large number of seeds, which appear to have a long viability, possibly for up to ten years. Can regenerate from cut material in moist conditions. Can be seen flowering throughout the year, flowers are bright yellow. material in moist conditions.

Cactaceae

Opuntia stricta

Prickly Pear

Native to N. and S. America. A low spreading, shallow rooted perennial cactus forming large clumps up to 1.5 metres tall. It has succulent segments to 20 cms. Long with clumps of short tufts of hair and spines. Flowers are bright yellow and fruit is dark purple (Auld & Medd, 1992). Seeds are dispersed by birds and adventitious roots will form if segments contact the ground. It is a declared category 4f noxious weed.

Cannaceae

Canna Indica

Canna Lily

Erect Herbaceous perennial up to 2m tall. Flowers are red to yellow on spikes at the top of the stems. Fruit is a textured capsule that dries and splits to release numerous smooth, black, ovoid seeds. Forms dense clumps in disturbed areas and along waterways. Seeds spread by birds, readily regrows from dumped garden waste. (Bushland Friendly Nursery Scheme, 2003)

Fabaceae

Erythrina x sykseii

Coral Tree

Hybrid probably from New Zealand. A tree to 15 metres high which does not set fruit. It readily grows from old stumps and cuttings (Harden, 1991, 414). Its bulk displaces native vegetation. Often found on stream banks and spreads through floating fallen branches.

Fabaceae

Erythrina x crista-galli

Cocks comb Coral Tree

Shrub or small tree to 6 m high, small prickles on the trunk and branches. Deciduous. Leaves are alternate and pinnately 3-foliolate. Flowers scarlet and often in clusters of three, appearing in spring.

Leucaena leucocephala

Leucaena

Tree to 8m high. Leaves compound (bipinnate). Flowers greenish to creamy white in round flowerheads about 2cm across in summer. Fruit a flat pod to 18cm long with 10-25 seeds. Seeds numerous and long lived. Spread by animals, water and humans. (Bush Friendly Nursery Scheme, 2003)

Lamiaceae

Westringia fruticosa

Westringia

A native shrub to 1.5m high. This shrub has been planted at this site. Leaves in whorls of 4, margins entire with a densely hairy petiole, flowers throughout the year. Although this plant grows near the sea and harbour foreshores it is not endemic to this location.

Lauraceae

Cinnamomum camphora

Camphor Laurel

Native of China and Japan. A large tree of spreading habit that can grow to approximately 25-30 metres. It has abundant seed production, effective dispersal mechanism, mainly by birds, and some seed dormancy. It is a hardy, long-living competitive tree which can also reproduce rapidly by suckering to form single species stands. Camphor Laurel prefers deep, well-drained red soil but will grow well on alluvial soil; it cannot, however, tolerate prolonged flooding (Firth, 1992, p.69). It is extensively naturalized in coastal areas on the North Coast of NSW (Harden, 1990, p.144). It is a declared W4(d) noxious weed (i.e. must not be sold, propagated or knowingly distributed and must be fully and continuously suppressed and destroyed).

Malvaceae

Lagunaria patersonii

Norfolk Island Hibiscus

Native to Lord Howe Island and Norfolk Island this tree reaches a height of 15m. Flower petals pale pink to mauve, slightly hairy on the outer surface. Trees covered with small scurfy scales, especially on the younger parts, Hardin (1990).

Myrtaceae

Leptospermum laevigatum

Coastal Tea Tree

A native of Australia on sand dunes and coastal cliffs, south from Nambucca Heads. A shrub or small tree to four metres, with smooth bark that sheds in strips. Leaves are narrow-obovate, 15-30 millimetres long and five to eight millimetres wide. Introduced onto NSW North Coast dunes after sandmining operations as part of the rehabilitation process.

Psidium guajava

Guava

A shrub or small tree up to 6 metres high (Harden, 1991, 192). Its fleshy fruit is attractive to birds which disperse the seed. Guava fruit yellows with age and has pink fruit it is often stung by fruit fly. It is resistant to glyphosate.

Ochnaceae

Ochna serrulata

Mickey Mouse Bush

Shrub two to three metres high. Leaves oblong to narrow elliptic, margins toothed. Ovoid drupes, five to eight millimetres long, black and embedded on a swollen red receptacle. Often cultivated. Native of South Africa (Harden, 1990, p. 490).

Pinaceae

Pinus elliottii

Slash Pine

A tall tree with ascending branches high on the trunk; the bark is reddish, shedding in thin scales. The tree is native to SE USA to Central America and the West Indies. (Harden, 1990–1993). Needle like leaves create a thick sterile layer beneath the tree.

Rutaceae

Murraya paniculata

Orange Jessamine

Native of India and Malaysia. A bushy shrub or small tree to 4 metres high. The red shiny berries are dispersed by birds and this plant is already naturalising in dry and subtropical rainforest on alluvial soil.

Solanaceae

Solanum mauritianum

Wild Tobacco

A shrub or small tree up to 4 metres high, widely naturalized in rainforest regrowth (Harden, 1992, 359). Its fruit are dispersed by birds. In areas of higher light levels it can form thick stands displacing native species by competing for water, space and nutrients.

Verbenaceae

Lantana camara

Lantana

Native of tropical South America. A scrambling shrub that often forms dense thickets (Harden, 1992, p.614) and can climb over 20 metres into trees. It grows best on well-drained, fertile soils including nutrient-enriched sands, roots also develop on branches which contact the ground, aiding its spread. It produces abundant seed, which is effectively dispersed by birds. According to Richard Lamb of Sydney University, when Lantana is present, particularly in sclerophyll communities, litter fall and nutrient turnover is altered, populations of native seeds are depleted, new seedlings are suppressed, soil structure is altered and micro-climate is changed, and some nutrients may be mobilized and lost to neighboring communities and others accumulated in unnatural amounts. These changed conditions seem to further favour Lantana and other weeds over native species (Buchanan, 1989, p.72) and in many forest areas can block secondary succession. It is a declared W3 noxious weed (i.e. must be prevented from spreading and its numbers reduced).

VINES AND SCRAMBLERS

Asparagaceae

Asparagus aethiopicus

Ground Asparagus

Native of South Africa. A shrub with sprawling stems up to two metres long, it is extensively naturalized in coastal districts and is a serious weed of bushland (Harden, 1993, p.46). It will form a total ground cover thereby preventing any germination of native species and inhibiting those that are present. It is a prolific seeder, making eradication difficult.

Basellaceae

Anredera cordifolia

Madeira Vine

Native of S. America. A climber with stems up to 20 metres long, producing tubers on roots and at nodes on aerial stems. It is widely naturalized in coastal districts, and is an invasive weed on the margins of rainforest (Harden, 1990, 177). This vine is extremely prolific, growing over 1 metre per week in warm, humid conditions. It produces countless vegetative aerial tubers which drop to the ground and remain dormant if conditions are not suitable for their growth. These tubers are spread by water, downhill movement and possibly rodents. The vine will rapidly smother plants of all sizes, destroying them through weight and inhibition of photosynthesis, and can block secondary succession (Hopkins). It is extremely difficult to control and is considered to be the most serious and destructive plant pest species affecting the North Coast rainforest remnants.

Convolvulaceae

Ipomoea cairica

Coastal Morning Glory

Native of tropical Africa and Asia. Perennial with twining and trailing stems. Violet to purplish violet flowers with a darker throat. Flowers throughout the year. Widely cultivated and frequently naturalised in coastal districts (Harden, 1992, p.380).

Fabaceae

Macropodium atropurpureum

Siratro

Decumbent or climbing perennial, stems two to three metres long, pubescent. Leaves three-foliolate two to seven centimetres long, lower surface densely whitish pubescent. Pods linear, four to ten centimetres long, pubescent. Native of Central and North America (Harden, 1991, p.423).

Passifloraceae

Passiflora. suberosa

Corky Passionfruit

Native of S. America. A slender vine with corky stems occasionally naturalized in disturbed rainforest in warmer areas (Harden, 1990, 435). Its foliage cover inhibits photosynthesis of supporting plants, which can also be damaged by its weight. Its seed is dispersed by birds and animals.

Passifloraceae

Passiflora subpeltata

White Passionflower

Native of Brazil. A climber which is a widespread weed along the coast on margins of rainforest and moist gullies (Harden, 1990, 435). Its foliage cover inhibits photosynthesis of supporting plants, which can also be damaged by its weight. Its seed is dispersed by birds and animals.

Solanaceae

Solanum seafortianum

Climbing Nightshade

Native of S. America. Sprawling perennial shrub or climber, naturalized in moister sites (Harden, 1992, 359). Like other vines, it causes stress on the support plant by its smothering action and weight. Its red berries are dispersed by birds

HERBS, FERNS AND GRASSES

Asteraceae

Conyza albida

Tall Fleabane

An erect herb usually more than 1m high which branches near the top to form a pyramidal flower. It occurs throughout temperate eastern Australia. Plants are generally summer growing and are locally common and seasonally abundant. (Auld & Medd, 1999)

Balsaminaceae

Impatiens wallerana

Balsam, Bush Lizzie, Impatiens

Annual or perennial succulent herb, to 1 metre high. Flowers mostly pink to red or white. Leaves alternate, margins crenate to deeply toothed. Flowers throughout the year. Often cultivated as an ornamental and garden escapees now found in many areas.

Commelinaceae

Commelina benghalensis

Hairy Commelina

Perennial herb, stems prostrate or ascending, sparsely and shortly pubescent, sometimes producing subterranean runners. Leaves pale green, apex obtuse to acute, base rounded or abruptly narrowed, sheath bearing long reddish hairs. Native of tropical Africa and Asia. Grows as a weed north of Comboyne (Harden, 1993, p.259).

Crassulaceae

Bryophyllum delagoense*

Mother-of-millions*

Native of South Africa and Madagascar. Erect, succulent, perennial herb, often suckering at the base and naturalized near habitation (Harden, 1990, p.528). Plantlets develop at the leaf tips forming a carpet of tiny plants, making it difficult to control.

Colchicaceae

Gloriosa superba

Glory Lily

Perennial herb with climbing annual stems arising from rhizomes. Leaves lanceolate, flowers orange, yellow or red. Flowers October to May. Widely cultivated, occasionally naturalised in coastal districts north of Sydney. Native of Africa and Asia (Harden, 1993, p.109).

Davalliaceae

Nephrolepis cordifolia

Fishbone Fern

A fern with rhizomes, and stolons which bear reproductive tubers (Harden, 1990, 63). Although a native of N.S.W., it is often cultivated and has naturalized near habitation. It is considered a weed in this area (Floyd, pers. comm.).

Dracaenaceae

Sansivera trifasciata

Mother-in-law's Tongue

Plant with a very short stem, strongly stoloniferous. Leaves dark green with light or greyish green bands, margins narrow, light green, yellow or reddish. Commonly cultivated as a pot plant, occasionally naturalised. Native of Africa (Harden, 1993, p.51).

Euphorbiaceae

Euphorbia cyathophora

Painted Spurge

Native of tropical America. An annual, erect herb flowering most of the year. It is naturalized on coastal sands (Harden, 1990, 425). It can form dense thickets up to 1.5 metres high (Cribb and Cribb, 1985, 123) inhibiting native regeneration.

Onagraceae

Oenothera stricta

Evening Primrose

Erect annual or biannual herb up to 100 centimetres high with basal rosette. Stem simple or branched with curved lateral stems. Basal leaves oblanceolate with a conspicuous midrib. Petals long, yellow and becoming red with age. Fruit cylindrical. Flowers all year. Native of Chile and Argentina. Cultivated and sometimes naturalised on disturbed sites (Harden, 1991, p. 207).

Poaceae

Melinis minutiflora

Molasses Grass

A native of Africa. A stoloniferous perennial grass up to 1.2 metres high (Harden, 1993, 461).

Melinus repens

Red Natal Grass

A native of South America the grass is a perennial or annual with erect slender stems up to 1m high. Flowers are a panicle of silvery white to pink or purple silky, hairy spikelet. *M. ripens* is a widespread roadside and railway embankment weed, particularly in coastal NSW and Qld. (Auld & Medd, 1999)

Pennisetum purpureum

Elephant or Bharna grass

A tall grass capable of growing to 3m native to South Africa. Often used as a windbreak.

Phytolaccaceae

Phytolacca octandra

Inkweed

Herb one to two metres high, woody at the base. Stems and flowers green to pinkish. Flowers in spring and summer, fruit red turning to black when ripe. Usually found in moist areas. Native of tropical America (Harden, 1990, p.176).

Rivina humilis

Coral Berry

Native of S. America. A shrub or perennial herb up to 1 metre high, growing chiefly on the coast in or on the margins of rainforest, often common in lowland subtropical rainforest (Harden, 1990, 176). It is moderately shade-tolerant, forming a dense understorey and can thereby suppress secondary succession. It bears numerous red berries almost all year round, making it difficult to control.

Stenotaphrum secundatum

Buffalo Grass

Glabrous, stoloniferous perennial to 0.3 metres high. Flowers in Summer. Grows on the coast but cultivated elsewhere. Native of America and Africa (Harden, 1993, p.541).

Portulacaceae

Portulaca pilosa

Ice Plant

A succulent prostrate annual. Occurs throughout Australia and is a common weed of cultivation in high rainfall areas. *P. pilosa* occurs on the North Coast of NSW and Queensland. The plant has pink flowers and conspicuous hairs (Auld & Medd, 1999).

Rubiaceae

Ricardia brasiliensis

Brazil Weed/ White Eye/Mexican Clover

A pale green, softly hairy, usually prostrate, clump forming perennial with opposite leaves. Flowers are very small, white and thickly clustered in the leaf forks. Native to South America (Kleinschmidt, Holland & Simpson, 1996)

Solanaceae

Solanum nigrum

Black-berry Nightshade

Herb or short lived perennial shrub, sometimes purple-green and hairy. Flowers white mainly in spring. Berry dull black or purple black. Widespread cosmopolitan weed found near habitations or in horticultural crops (Harden, 1992, p.356).

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Appendix 5: Weed Treatment Methods

1. **“Cut-scrape-paint”**: this method applies to all woody shrubs, trees and some vines.
 - (a) Cut plant low to the ground at an angle.
 - (b) Apply Glyphosate immediately at the rate of 1 part Glyphosate: 1.5 parts water, with a paintbrush approximately 1.5 centimetres wide.
 - (c) Scrape sides lightly to reveal green tissue and apply the herbicide to the scraped area.
 - (d) Take care that the brush is not contaminated with soil.

Note: all seed that has high viability and longevity, e.g. *Senna* spp. and other members of the Fabaceae family, or plants with a high invasive potential, such as *Schefflera actinophylla*, must be removed from the parent and either composted on site or removed from the site.
2. **“Gouge-paint”**: this method applies to those plant species that have a fleshy root system, such as rhizomes or large bulbs. It is particularly appropriate for the treatment of *Asparagus* spp. (Asparagus).
 - (a) Gouge out sections of the fleshy base with a knife (if using on Asparagus, first cut the stems at shoulder height and also at the base).
 - (b) Apply 1 part Glyphosate: 1.5 parts water immediately, with a paint brush approximately 1.5 centimetres wide.
3. **“Stem Injection”**: this method applies to all woody trees and shrubs with a diameter of about six to ten centimetres or greater.
 - (a) With a tomahawk, make a cut the width of the blade, at a slight angle, into the trunk.

Note: it is important not to make cuts too deep.
 - (b) Apply herbicide immediately into the cut using a tree-injecting device (if using Glyphosate, apply at the rate of 1 part Glyphosate: 1.5 parts water).
 - (c) Repeat this procedure in a brickwork pattern around the circumference of the tree, as close to the ground as possible. Where the presence of a crotch angle makes this difficult, make a cut above it. **Note:** two rows of cuts will be sufficient for trees with trunks of six to ten centimetres; larger trunk diameters will need correspondingly more.
 - (d) Treat all visible lateral roots as per (a).
4. **“Scrape-ditch-paint”**: this method is applicable to many species of vines where it is desirable to treat the vines intact, particularly those with aerial tubers such as *Anredera corifolia* (Madeira Vine) or those which will propagate from segments, e.g. *Delairia odorata* (Cape Ivy).
 - (a) Scrape the stem tissue on one side of the stem only for at least 20-30 centimetres if possible. **Note:** on Madeira Vine, it is necessary to scrape heavily. Scrape as many sections of the stem as possible.
 - (b) Apply undiluted Glyphosate with a paintbrush.
 - (c) On stems that are thicker or horizontal, make a ditch into the stem with a knife and apply herbicide. Tubers and side roots should be treated the same way. **Note:** care must be taken not to sever the stem.
5. **“Spraying”**: this is carried out using a 15 litre backpack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used with the addition of a marker dye. For plants that show some resistance (e.g. Madeira Vine) or where growing conditions are not optimal, an acidifying agent, such as Protec® is added (in the past LI700® has been used. Protec® is an oil based alternative which is effective and more versatile in its applications), is added. Metsulfuron can also be used for resistant species and grasses. It should be used with a surfactant, such as Protec® (Previously Protec® has been used for this purpose).

Note: where both Glyphosate and Metsulfuron are recommended for a species, it may be possible to use a commercially available compound of these two herbicides. This approach is currently under trial and is not suitable for operators unskilled in precision spraying.

Note: dilution rates for Glyphosate and Metsulfuron are in accordance with the manufacturer's recommendations and any variation requires a permit from the National Registration Authority.

Dilution Rates (Glyphosate: water):

- Plants with more or less succulent leaves, e.g. *Tradescantia fluminensis*, *Anredera cordifolia* (autumn to winter is the suggested time for spraying these plants), *Chlorophytum* spp. etc.
1 part Glyphosate: 50 parts water + Protec®
- *Lantana camara*
1 part Glyphosate: 100 parts water
- Other soft-leaved plants, annuals and grasses
1 part Glyphosate: 100 parts water
- *Chrysanthemoides monilifera* subsp. *rotundata*
1 part Glyphosate: 150 – 400 parts water

Dilution Rates (Metsulfuron: water):

- 1.5g Metsulfuron: 10 litres water + Protec®:

6. **“Overspray”:** this method is applicable to large, dense infestations of such plants as *Chrysanthemoides monilifera* subsp. *rotundata* (Bitou Bush) and *Lantana camara* (Lantana), where it is desirable to leave the dead plants intact to prevent erosion and over-exposure of large areas, protect native seedlings from predators such as wallabies, and avoid trampling by humans.

- (a) Spray over the top of the infestation, using a weak solution of Glyphosate.
Note: any native plants that may be under the weed will be protected by the foliage cover of the weed.
- (b) Leave the sprayed plants intact so that native seedlings can establish under the shelter provided.

Note: Lantana – 1 part Glyphosate: 100 parts water

Bitou Bush – 1 part Glyphosate: 150 parts to 400 parts water

Alternatively: weeds can be cut and flattened with bush-hooks or loppers and the subsequent regrowth sprayed with Glyphosate.

Note: in many cases it is preferable to overspray wherever practicable as this will cause less erosion and trampling of suppressed native plants, such as ferns and seedlings. However, handwork will be necessary to “cut-scrape-paint” any unsprayed Bitou Bush or Lantana that surrounds native plants.

7. **“Crowning”:** this method is applicable to weeds which have their growing points below the surface of the ground (corms, bulbs, rhizomes, clumped or fibrous root systems, etc. e.g. *Asparagus* spp., *Chlorophytum comosum* and grasses).

- (a) Grasp the leaves or stems and hold them tightly so that the base of the plant is visible. Plants with sharp leaves or stems should be cut back first.
- (b) Insert the knife close to the base of the plant at a slight angle, with the tip well under the root system.
- (c) Cut through the roots close to the base. Depending on the size of the plant, two or more cuts may be needed to sever all the roots.
- (d) Remove the plant. Make sure that the base of the plant where the roots begin is completely removed.

Source: adapted from Joseph, R., 2001. *Course Notes from Certificate II in Bushland Regeneration*. TAFE, Wollongbar.

Appendix 6: Treatment methods for some of the more common weeds at Angels Beach

Note: Ratios for Application of Herbicide

Dilution ratios for application of a mix of herbicide (Glyphosate based such as Round Up®) and water are provided. For example, 1:50 means that one part by volume of herbicide is mixed with fifty parts by volume of water. All cut, scrap and paint at 1:1.5 refers to Glyphosate. For some weeds a combination of Glyphosate and Metsulfuron is recommended, however a permit will be required for this off label usage.

Protec ® is added in some treatments to assist the transfer of the herbicide through the surface tissue – particularly plants with waxy leaves, such as Camphor Laurel, Madeira Vine and Wandering Jew.

For more detail on control method techniques refer to Appendix 5: Weed Removal and Control Techniques

Trees and Shrubs

Scientific Name	Common Name	Control Method
<i>Chrysanthemoides monilifera</i> spp. <i>Rotundata</i>	Bitou Bush	Hand pull young seedlings and hang up, cut, scrape & paint 1:1.5 small plants. Over spray mature plants if no risk to native seedlings, <i>glyphosate 1:200</i>
<i>Cinnamomum camphora</i>	Camphor Laurel	Stem inject 1:15 larger trees, cut scrape and paint 1:1.5 small plants. Spray seedlings <i>glyphosate 1:50 + Protec ®</i>
<i>Lantana camara</i>	Lantana	Lopper and cut, scrape and paint base 1:1.5 .. Spray regrowth <i>glyphosate 1:100 + Protec®</i>
<i>Leptospermum laevigatum</i>	Coast Tea Tree	Cut close to ground and bag seed.
<i>Ochna serrulata</i>	Mickey Mouse Bush	Cut, scrape and paint 1:1.5 . Spray seedlings <i>glyphosate 1:50 + Protec®</i> Difficult to pull will regrow from broken root. Paint stem on larger specimens with neat <i>glyphosate</i> to a height of 50 cm
<i>Schefflera actinophylla</i>	Umbrella Tree	Hand pull seedlings and bag. Cut, scrape and paint or stem inject 1:1.5 . Cut sections, can regrow if left on the ground
<i>Senna pendula</i> var. <i>glabrata</i>	Winter Senna	Hand pull young plants or spray seedlings <i>glyphosate 1:50 + Protec. ®</i> Cut, scrape and paint 1:1.5 . Stem inject large specimens 1:1.5 , bag seeds

Vines and Scramblers

Scientific Name	Common Name	Control Method
<i>Asparagus aethiopicus</i>	Ground Asparagus	Hand remove (crowning of rhizome). Spray Metsulfuron 1.5g/10L and Protec® 20ml/10L .
<i>Gloriosa superba</i>	Glory Lily	Difficult to control, spray foliage <i>glyphosate</i> (1:50 + Protec® + mefsulfuron (1 gram: 10L) in spring when plants are small – September/October. Follow-up required.
<i>Ipomoea cairica</i>	Coastal Morning Glory	Hand pull, cut scrape and paint 1:1.5 . Roll up vines, spray <i>glyphosate</i> 1:100 + Protec®
<i>Ipomoea indica</i>	Blue Morning Glory	Cut, scrape and paint stem 1:1.5 . Hand pull running stolons, roll up and allow to dry out by suspending above ground. Spray small plants and seedlings <i>glyphosate</i> 1:50 + Protec® . Bag fruit
<i>Solanum seafortianum</i>	Climbing Nightshade	Hand pull or scrape and paint 1:1.5 . Best to locate the flower. If in seed, bag the fruit

Herbs, Ferns and Grasses

Scientific Name	Common Name	Control Method
<i>Bryophyllum delagoense</i>	Mother of Millions	Hand removal of all plants where possible; spray plantlets. Metsulfuron 1.5g/10L with Protec®
<i>Bryophyllum delagoense</i>	Resurrection Plant	Hand removal of all plants where possible; spray plantlets <i>glyphosate</i> 1:50 with Brush Off 1.5g/10L and Protec®
<i>Conyza albida</i>	Tall Fleabane	Hand remove or spray <i>glyphosate</i> 1:100
<i>Conyza palida</i>	Small Fleabane	Hand remove or spray <i>glyphosate</i> 1:100
<i>Cynodon dactylon</i>	Common Couch	Spray <i>glyphosate</i> 1:100
<i>Euphorbia cyathophora</i>	Painted Spurge	Spray <i>glyphosate</i> 1:100 + Protec® . Hand pull
<i>Sansevieria trifasciata</i>	Mother In Laws Tongue	Spray Metsulfuron 1.5g/10L with Protec® 20ml/10L
<i>Senecio madagascariensis</i>	Fireweed	Hand pull
<i>Seteria viridis</i>	Pigeon Grass	Spray <i>glyphosate</i> 1:100
<i>Solanum nigrum</i>	Blackberry Nightshade	Handpull
<i>Sorghum halepense</i>	Johnson Grass	Spray <i>glyphosate</i> 1:100
<i>Sphagneticola trilobata</i>	Singapore Daisy	Trial Metsulfuron 1.5g/10L with Protec® 20ml/10L
<i>Stenotaphrum secundatum</i>	Buffalo Grass	Spray <i>glyphosate</i> 1:100 + Protec®

Note: Unless otherwise stated the herbicide recommended for the techniques described above is Glyphosate e.g. Roundup®. Protec® should be used as per manufacturer's instructions. An off label permit is required from the National Registration Authority for any combination of herbicides or for rates not described on the product labels.

Appendix 7: ROTAP Classifications

CODING SYSTEM

- 3** the Distribution Category for the species (can be 1, 2 or 3)
- R** the Conservation Code (can be X, E, V, R or K)
- C** indicates the species is reserved (a blank in this space indicates it is not reserved)
- a** indicates adequacy of reserved population size (alternatives are a, i, -). If C is not present then this code will not be used.

DISTRIBUTION CATEGORY (NUMERICAL CODE)

- '1'** Species known only from the type collection.
- '2'** Species with a very restricted distribution in Australia and with a maximum geographic range of less than 100 km (e.g. *Hibbertia paeninsularis* – coded 2E).
- '3'** Species with a range over 100 km in Australia but occurring only in small populations which are mainly restricted to highly specific and localised habitats (e.g. *Drabastrum alpestre* – coded 3RC).

CONSERVATION STATUS (ALPHABETICAL CODE)

- 'X'** Presumed Extinct – species that have either not been found in recent years despite thorough searching, or have not been collected for at least 50 years and were known only from now intensively settled areas (e.g. *Ptilotus extenuatus* – coded 2X).
- 'E'** Endangered – species in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate (e.g. *Hibbertia paeninsularis* – coded 2E).
- 'V'** Vulnerable – species not presently Endangered but at risk of disappearing from the wild over a longer period (20-50 years) through continued depletion, or which largely occur on sites likely to experience changes in land use that would threaten the survival of the species in the wild (e.g. *Hemiandra gardneri* – coded 2V).
- 'R'** Rare – species which are rare in Australia but which overall, are not currently considered Endangered or Vulnerable. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wider range, or some intermediate combination of distribution pattern (e.g. *Drabastrum alpestre* – coded 3RC).
- 'K'** Poorly Known – species that are suspected, but not definitely known, to belong to any of the above categories. At present field distribution information is inadequate (e.g. *Melaleuca nanophylla* – coded 3K).

Appendix 8: Bird List for Angels BeachR.E.=Rare/Endangered **Bold-faced**

Common name	Scientific name
Brown Thornbill	<i>Acanthus pusilla</i>
Grey Goshawk	<i>Accipiter novaehollandiae</i>
Australian Brush-Turkey	<i>Alectura lathami</i>
Australian Darter	<i>Anhinga melanogaster</i>
Common or Greater Noddy	<i>Anous stolidus</i>
Brush Wattlebird	<i>Anthochaera chrysoptera</i>
Richard Pipit	<i>Anthus novaeseelandiae</i>
White-faced Heron	<i>Ardea novaehollandiae</i>
Ruddy Turnstone	<i>Arenaria interpres</i>
Masked Wood Swallow	<i>Artamus personatus</i>
White-breasted Woodswallow	<i>Artamus superciliosus</i>
Fan-tail Cuckoo	<i>Cacomantis flabelliformis</i>
Brush Cuckoo	<i>Cacomantis variolosus</i>
Red Knot	<i>Caledris canutus</i>
Sanderling	<i>Calidris alba</i>
Red-necked Stint	<i>Calidris ruficollis</i>
Glossy Black Cockatoo	<i>Calyptorhynchus lathami</i>
Pheasant Coucal	<i>Centropus phasianinus</i>
Double banded Plover	<i>Charadrius bicinctus</i>
Redcapped Plover	<i>Charadrius ruficapillus</i>
Grey Shrike-Thrush	<i>Colluricincla harmonica</i>
Black-faced Cuckoo-Shrike	<i>Coracina novaehollandiae</i>
Torresian Crow	<i>Corvus orru</i>
Pied Butcherbird	<i>Cracticus nigrogularis</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Kookaburra	<i>Dacelo novaeguineae</i>
Mistletoe Bird	<i>Dicaeum hirundinaceum</i>
Spangled Drongo	<i>Dicrurus megarhynchus</i>
Reef Heron (Eastern Reef Egret)	<i>Egretta sacra</i>
Black-shouldered Kite	<i>Elanus axillaris</i>
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>
Eastern Yellow Robin	<i>Eopsaltria australis</i>
Little Penguin	<i>Eudyptula minor</i>
Nankeen Kestrel	<i>Falco cenchroides</i>
Bar-shouldered Dove	<i>Geopelia humeralis</i>
Brown Warbler	<i>Gerygone mouki</i>
Australian Magpie	<i>Gymnorhina tibicen</i>
Sooty Oystercatcher R.E.	<i>Haematopus fuliginosis</i>
Pied Oystercatcher R.E.	<i>Haematopus longirostris</i>
Sacred Kingfisher	<i>Halcyon sanctus</i>
White-breasted Sea-eagle	<i>Haliaeetus leucogaster</i>
Brahminy kite	<i>Haliastur indus</i>
Whistling kite	<i>Haliastur sphenurus</i>
Wandering Tattler	<i>Heteroscelus incanus</i>
Welcome Swallow	<i>Hirundo neoxena</i>
Varied Triller	<i>Lalage leucomela</i>
Silver Gull	<i>Larus novaehollandiae</i>
Brown Honeyeater	<i>Lichmera indistincta</i>
Bar-tailed Godwit	<i>Limosa lapponica</i>

Common name	Scientific name
Red Backed Fairy Wren	<i>Malurus melanocephalus</i>
Variiegated Fairy Wren	<i>Malurus assimilis</i>
Superb Fairy Wren	<i>Malurus cyaneus</i>
Noisy Miner	<i>Manorina melanocephala</i>
Lewin's Honeyeater	<i>Meliphaga lewinii</i>
Rainbow Bee Eater	<i>Metrops ornatus</i>
Australian Gannet	<i>Morus serrator</i>
Leaden Flycatcher	<i>Myiagra rubecula</i>
Scarlet Honeyeater	<i>Myzomela sanguinolentoi</i>
Red-browed Finch	<i>Neochmia temporalis</i>
Whimbrel	<i>Numenius phaeopus</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Olive-backed Oriole	<i>Oriolus sagittatus</i>
Osprey R.E.	<i>Pandion haliaetus</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Pied Cormorant	<i>Phalacrocorax varius</i>
Noisy Friarbird	<i>Philemon corniculatus</i>
White-cheeked Honeyeater	<i>Phylidonyris nigra</i>
Eastern Rosella	<i>Platycercus eximius</i>
Golden Plover	<i>Pluvialis sp.</i>
Eastern Whipbird	<i>Psophodes olivaceus</i>
Wedge-tailed Shearwater	<i>Puffinus pacificus</i>
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>
Grey Fantail	<i>Rhipidura fuliginosa</i>
White-browed Scrubwren	<i>Sericornis frontalis</i>
Figbird	<i>Sphecotheres viridis</i>
Little Tern R.E.	<i>Sterna albifrons</i>
Crested Tern	<i>Sterna bergii</i>
Caspian Tern	<i>Sterna caspia</i>
Common Tern	<i>Sterna hirundo</i>
Gull-billed Tern	<i>Sterna nilotica</i>
Pied Currawong	<i>Strepera graculina</i>
Scaly-Breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>
Masked Lapwing	<i>Vanellus miles</i>
Silvereye	<i>Zosterops lateralis</i>

Appendix 9: Vertebrate Fauna list for Angels Beach area

Classification	Common name	Scientific name
Reptiles	Burton's Legless Skink	<i>Lialis burtonis</i>
	Land Mullet	<i>Tiliqua scincoides</i>
	Eastern Grass Skink	<i>Lampropholis delicata</i>
	Eastern Water Dragon	<i>Physignathus lesuerii</i>
	Land Mullet	<i>Egernia major</i>
	Pink Tongue Lizard	<i>Tiliqua gerrardii</i>
	Skinks	<i>Carlia or Sphenomorphus tenius murrayi</i>
	Striped Skink	<i>Ctenotus robustus</i>
	Lace Monitor	<i>Varanus varius</i>
	Three Toed Skink	<i>Saiphos equalis</i>
	Bandy-Bandy	<i>Vermicella annulata</i>
	Carpet python	<i>Morelia spilota variegata</i>
	Eastern brown	<i>Pseudonaja textilis</i>
	Green Tree Snake	<i>Dendrelaphis punctulata</i>
	Grey Swamp (Marsh) Snake	<i>Hemiaspis signata</i>
	White Blind (Worm) Snake	<i>Pseudechis porphyriacus</i>
	Small-eyed snake	<i>Cryptophis nigrescens</i>
	Southern Death Adder	<i>Acanthophis antarcticus</i>
	White Blind (Worm) Snake	<i>Ramphotyphlops</i>
	Yellow-faced whip	<i>Demansia psammophis</i>
Monotreme	Short-beaked Echidna	<i>Tachyglossus aculeatus</i>
Mammals	*Black Rat	<i>Rattus rattus</i>
	*House Mouse	<i>Mus musculus</i>
	Brown Marsupial Mouse	<i>Antechinus stuartii</i>
	Bush Rat	<i>Rattus fuscipes</i>
	Northern Brown Bandicoot	<i>Isodon macrourus</i>
	Pademelon	
	Common Brushtail Possum	<i>Trichosurus vulpecula</i>
	Grey-headed Flying Fox-Swamp Rat	<i>Rattus lutreolus</i>
Amphibians	Striped Marsh Frog	<i>Limnodynastes peronii</i>
	*Cane Toad	<i>Bufo marinus</i>
	Wallum frog	<i>Crinia tinnula</i>
	Dainty Green Tree Frog	<i>Litoria gracilentia</i>
	Sharp Snouted Reed Frog	<i>Litoria oblongburensis</i>
	Peron's Tree Frog	<i>Litoria peronii</i>

* indicates an introduced species

Appendix 10: Tools and Equipment Required

Non-consumables

- Plastic or steel boxes for equipment storage
- Leather pouches with belts to secure secateurs and knives
- Felco® secateurs (no.5)
- Victorinox® boning knives with non-slip handles
- Sandvik® loppers (no.16)
- Large bow saw
- Small pruning saws
- Poison pots, stands, and paintbrushes
- Goggles for mixing and applying herbicide
- Tomahawk
- Tree injection unit
- Sharpening stone
- Post hole shovels for tree planting
- Hoses
- Wheel barrow
- Chemical measuring container
- Rubber gloves for measuring and applying herbicide
- Gardening gloves
- 15 litre backpack spray unit with Rega® nozzle
- Fertilizer (or other large) sacks for weed and tuber removal
- Black builders' plastic for composting
- Native plant and weed identification manuals
- Hand lens
- Camera
- First aid kit
- Tarp for laying tools out on when the ground is wet (various other uses i.e. erecting sunshade, rain protection etc.)

Consumables

- Aerosol oil for tool maintenance (WD40® or Inox®)
- Tree fertilizer tablets (Agriform®)
- Diary/ journal
- Work record sheets (see Appendix 7)
- Flagging tape
- Photographic film
- Glyphosate (Roundup®)
- LI700® - acidifier
- Metsulfuron (Brushoff® or Brush Killer®)
- Agral® – surfactant
- Spray marker dye
- Fencing material – timber posts, pig wire, shade cloth
- Trees for planting
- Nitram® – fertiliser
- Water crystals or wetting agent
- Tree guards and/or wallaby repellent spray
- Stakes or star pickets for photo points

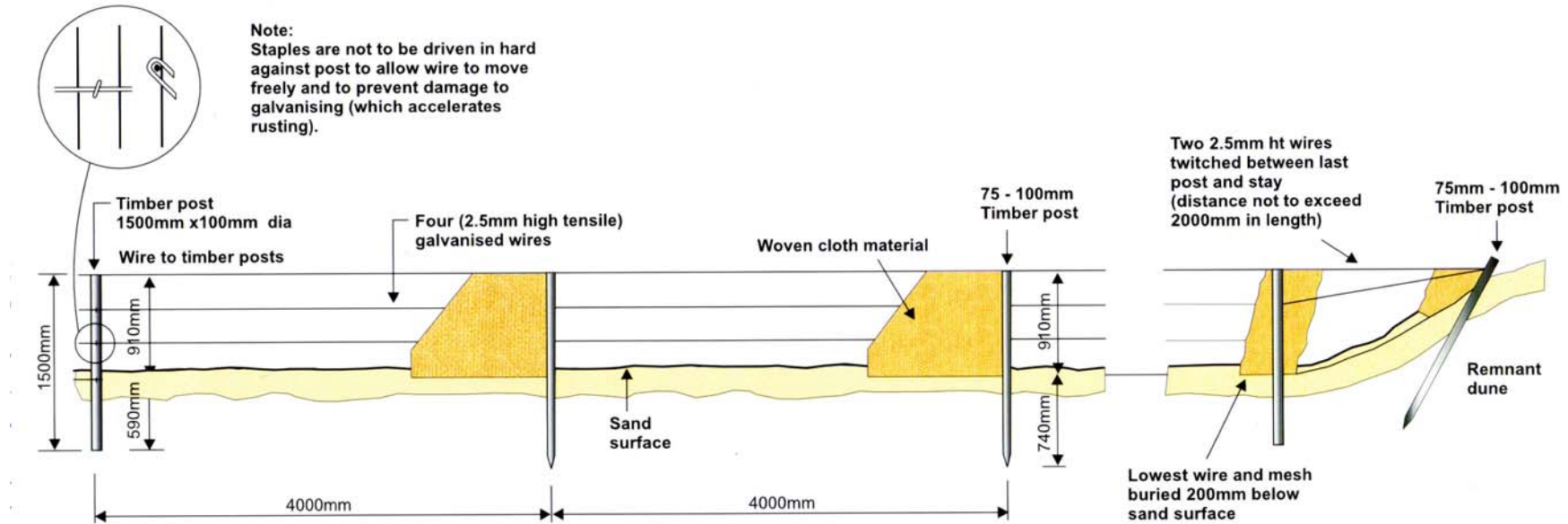
Appendix 11: Regeneration Record Sheet

This record sheet is used to record bush regeneration activities carried out each day. The records provide a valuable tool for monitoring project work. It is recommended that Dunecare groups maintain a file of these records and also provide copies to Byron Shire Council.

REGENERATION RECORD SHEET

Remnant Name:		Date:	
Personnel/Volunteers:		Hours Worked:	
Weather Conditions (temperature, prevailing wind, cloud cover etc.):			
Work Completed (work zone – use map on reverse, methods trialed, comments on previous works, monitoring, followup or reminders etc.):			
Weeds Treated		Methods Used	
Chemical	Vol. Used (ml)	Chemical	Vol. Used (ml)
Payment/Funding		Invoice No.	
Observations (flora, fauna, fruiting, flowering etc.):			
Accidents/Incidents/Near Misses:			

Appendix 12: Dune Fencing Diagram



Notes:

1. Wire and mesh to go on seaward or prevailing weather side of fence.
2. Mesh to be fastened to all wires using ring fasteners at 100-150mm intervals on top wire and 300mm intervals on other wires.
3. Use one wooden post every 4000mm.
4. Metal posts should be avoided.

Kidd, 2001.