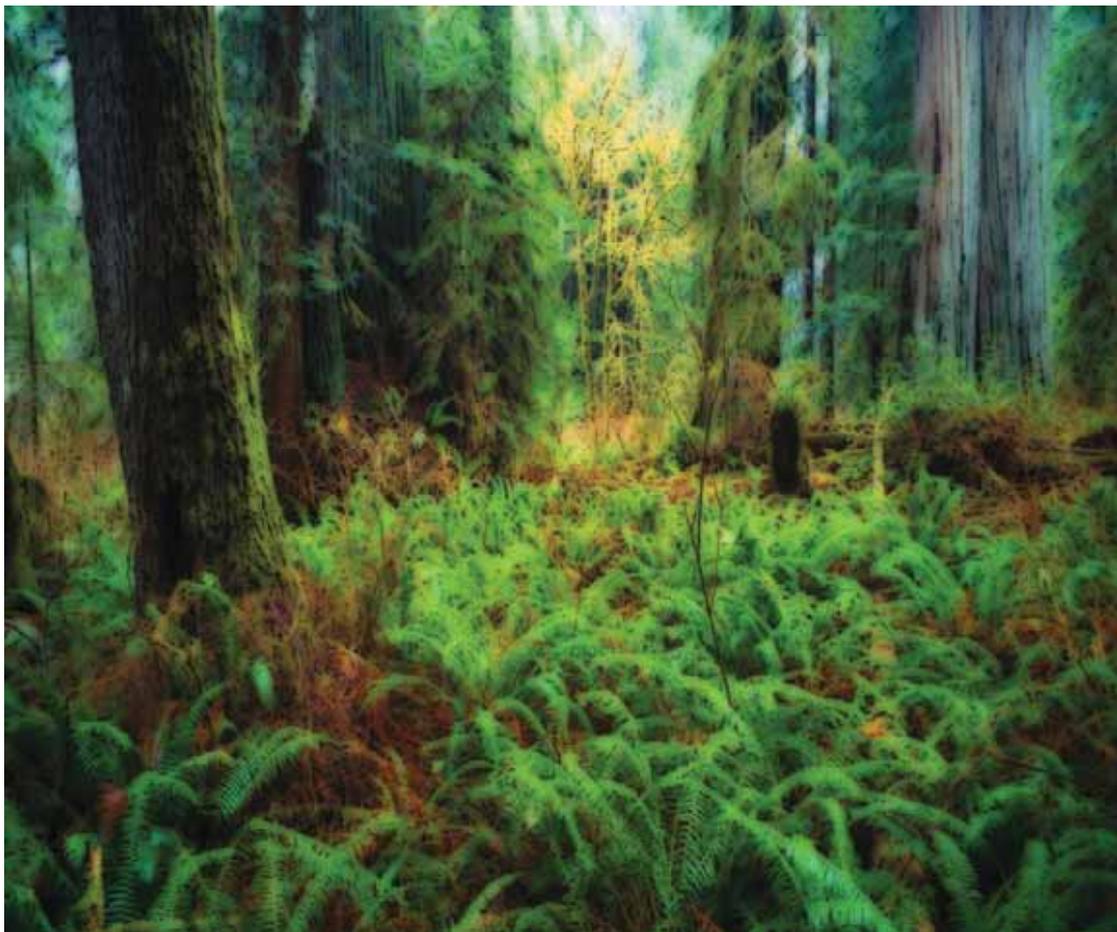


# BOYTERS LANE PLAYING FIELDS & WETLANDS

## NATIVE VEGETATION REHABILITATION IMPLEMENTATION STRATEGY

2008

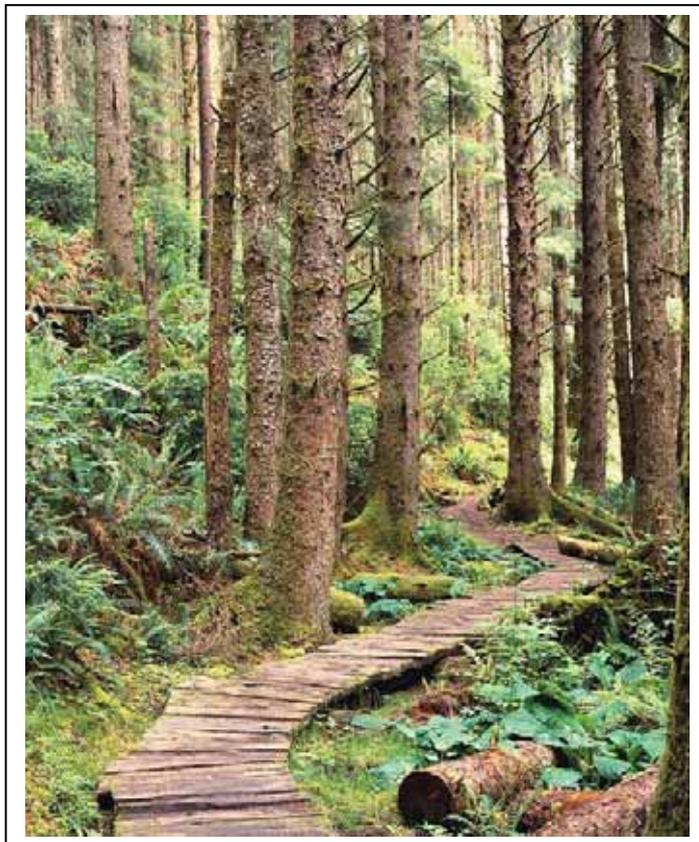


Prepared by Kempsey Shire Council  
June 2008

## FORWARD

**This Native Vegetation Rehabilitation Implementation Strategy has been developed in accordance with the recommendations described in the Boyters Lane Playing Fields and Wetlands Plan of Management April 2005.**

**This strategy details a staged adaptive management approach to achieve the objective of sustained ecological management for all vegetation communities within the area pertaining to the Boyters Lane Playing Fields and Wetlands Plan of Management.**



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# 1. Introduction

A Vegetation Management Plan is a site-specific document that provides a guideline for the management and/or rehabilitation of vegetation communities within a specified location. The Boyters Lane Vegetation Management Plan (BLVMP) provides a range of management options and strategies to re-establish native vegetation in identified landscapes within the Boyters Lane wetland areas and landscapes adjacent to the playing fields areas.

The Boyters Lane Wetland area is classified as a coastal wetland. Coastal wetlands are a distinctive group of habitats that contain specialised aquatic and terrestrial ecosystems. The BLVMP primarily focuses on the management of the terrestrial landscapes and ecosystems within Lot 78 (DP754396), Lot 79 (DP754396) and Lot 802 (DP832777) and also all existing native vegetation and vegetation associated with the constructed stormwater wetlands.

## 1.1 Background

Kempsey Shire Council purchased 25.8ha of land on Pelican Island with the intention of developing playing fields on the western side of Teal Lagoon. The remaining lands to which this document relates are to be managed to protect and enhance the sites ecological integrity. Council is also keen to develop as part of the rehabilitation strategy an environmental awareness/educational program.

## 1.2 Revegetation Project Objective

The fundamental objectives of the Boyters Lane revegetation project are to;

- 1) Revegetate areas of the Boyters Lane site with native vegetation
- 2) Improve and protect the ecological character of the site, and
- 3) Improve community environmental awareness

### 1.2.1 Aims, Objectives and Purposes of Vegetation Plan

The aim of the BLVMP is to outline the necessary measures and considerations required to ensure that the outcomes of the Boyters Lane Rehabilitation program results in a self-sustaining functional ecosystem.

The objectives of the BLVMP is provide Kempsey Shire Council with a strategic framework that builds on existing plans and policies relevant to the area and provides direction to Council for the purpose of implementing revegetation and/or vegetation management recommendations described in the aforementioned documents.

The purpose of the BLVMP is to ensure proper guidelines are developed and strategies implemented to promote “Best Practice” in native vegetation establishment and management, detail responsibilities and ensure compliance with appropriate legislation that culminates in the creation of a stable and functioning environment which is consistent with the surrounding landscape and other environmental values.

## 1.3 Plans and Policies

- 1) Boyters Lane Playing Fields and Wetlands Plan of Management (2005)
- 2) Boyters Lane Wetland Audit
- 3) Boyters Lane Wetland Environmental Education Plan (2007)
- 4) KSC Open Space Strategy
- 5) KSC Ecological Sustainable Development Strategy

## 2. Site Location

The Boyters Lane site on Pelican Island is situated in the lower Macleay River, with Spencers Creek forming the northern and eastern boundary of the island. The site is in total 28.4ha in area containing wetlands, estuarine inlets and grassland.



Figure 1 Site location of Boyters Lane Revegetation Project

## **3. Existing Site Conditions**

### **3.1 Site Characteristics**

The Boyters Lane site is adjacent to an estuarine environment in the lower Macleay River (Figure 1).

The three small estuarine embayment's on the Boyters Lane site grade evenly from south to north, gradually deepening towards the water. Aerial photographs suggest the Boyters Lane site results from the development of point bars in the meander belt of the lower Macleay or a tributary. As the point bars built outwards towards the present-day Spencers Creek, 'sloughs' and meander scrolls were left behind.

#### **3.1.1 Climate and Rainfall**

The climate of the South West Rocks area is generally humid and is typical of a warm temperate to subtropical zone. The area has a regular late winter-spring dry season and summer-autumn wet period, often characterised by rain depressions of tropical origins, when heavy rainfalls occur in intense events that often trigger environmental consequences such as large-scale acid sulfate runoff, soil erosion, and mobilisation of pollutants.

Although extended dry periods are uncommon, the sub soils will steadily dry out and stream flow will fall markedly. Atkinson (1999) reported that although the July-December dry period of each year was likely to produce a soil water deficit, Edwards (1979) had calculated a soil water surplus for all months. Growing conditions are probably generally favorable over much of the year in most years. The mean annual rainfall for South West Rocks is 1,367mm, with a mean annual evaporation of 1,502 mm. The mean annual number of rain days for the area is 138.

#### **3.1.2 Geography**

Atkinson (1999) and Eddie (2000) have mapped the soil landscapes and discussed the Quaternary fluvial sediments and barrier sands of the Lower Macleay system. The Boyters Lane area is part of the Gladstone Alluvial Plains, and contains two soil types – *tm* (Toormina) and *mr* (Maria River) (see 2.3.2 Soil Types, below). Although a detailed study of geomorphology of the Boyters Lane site is not known, a broad understanding of the natural history of the site can be inferred.

The extensive Pleistocene (roughly pre-10,000 years ago) and Holocene (within the last 10,000 years) riverine sediments of the lower Macleay floodplain consist of gravel beds overlain by silts and clays in the estuarine reaches (the Boyters Lane zone). These estuarine reaches, typified by the Boyters Lane landscape, contain complex patterns of sedimentation, with fluvial deltaic deposition over estuarine muds of coastal lagoons. With progressive infilling by alluvial sediments the estuarine lagoons become freshwater swamps and then alluvial backplains.

##### **3.1.2.1 Acid Sulfate Soils**

Acid sulfate soils (ASS) are sediments deposited under estuarine conditions such as in mangroves or seagrass beds, and which contain the sulfidic mineral pyrite ( $\text{FeS}_2$  - iron and disulfide). These soils underlie many coastal floodplains, in coastal wetlands, and as bottom sediments in today's coastal estuaries. As long as ASS are not disturbed or drained, these materials are relatively harmless and are termed

potential Acid Sulfate Soils (PASS). If the sediments are exposed to air, the pyrite is oxidised to sulphuric acid, ferric iron, and other metals. The reaction products can be not only toxic in the short and long term, but exert a very high oxygen demand upon entry to waterways.

Boyers Lane is not within an identified ASS Hotspot Priority Management area, and is not regarded as a high-risk zone. However, the whole site is included on the ASS Risk Maps under different classifications. Council's GIS information shows the risk of Acid Sulfate Soils on some portions of the site to be very high. While there was no visible evidence of ASS on the site, such as iron oxides or black oozes, ASS is likely to occur below the surface. There is also the possibility that ASS exists in low concentrations, or could already be at least partly oxidised and leached out of the more elevated soils.

### **3.1.3 Geology and Soils**

There are two types of soils that have been identified within the Council-owned Boyters Lane property and one on adjacent land not occurring on the site (kr: Korogoro). The soils found within the site are the Maria River (mr), as described by Atkinson (1999), and the Toormina (tm) soil types, described by Eddie (2000). Maria River (mr) (Atkinson, 1999)

Landscape - Extensive level plains, floodplains and backswamps on Holocene alluvium in the lower reaches of the major streams. Relief <1 m; elevation 1 - 3 m. Swamp species often cleared for grazing. Soils - Various alluvial clays forming moderately deep (100 - 150 cm) Humic Gleys and grey and yellow duplex soils. These overlie buried Pleistocene barrier sands or Holocene estuarine sediments.

Limitations - Regular flooding hazard; waterlogging; foundation hazards; strongly acidic; sodic soils; low wet bearing strength; low permeability; organic soils (localised); salinity (localised); acid sulfate soils (localised).

Toormina (tm) (Eddie, 2000) Landscape - Level intertidal and supratidal flats on Holocene sands and muds. Elevation <2 m. Bare sand and mud grading to mangroves, saltmarsh and swamp sclerophyll forests. Soils - Sulfidic Intertidal and Supratidal Hydrosols (Humic Gleys and Solonchaks) on muddy sediments, with Arenaceous Intertidal Hydrosols (Siliceous Sands) on sand flats.

Significant Soil and Land Qualities - Organic soils with low wet bearing strength, sodicity, high erodibility, high subsoil permeability, extreme acid sulfate potential, strong salinity and low fertility. Poor drainage; tidal flood hazard; permanently high watertables; groundwater pollution hazard; non-cohesive soils; extreme engineering hazard; localised soil fire hazard (drained supratidal flats).

### **3.1.4 Hydrology**

The hydrology, or process of water movement, across the Boyters Lane land has been extensively modified by construction of the main berm across all three inlets. The aim of berm construction was apparently to reduce or eliminate saltwater by blocking tidal inflows, and allow freshwater (rainfall runoff) to flow out to the estuary through the 150mm PVC pipes apparently originally fitted with small flapgates. Several of the pipes have lost flaps and are fully open, although in the Teal Berm appear to be blocked, possibly by oyster growth.

Teal Lagoon is the westernmost inlet of the three, and appears to be situated at a lower elevation than the other two. This pattern fits the geomorphological

explanation of the natural history of the site as a series of river levees and point bars successively overtaken by channel development in a northerly direction, probably as a result of flood-related breakthroughs. Each inlet may be a relict channel. Depths within the Teal Lagoon vary but are commonly 20-70cm in the middle, and the lagoon does not appear to dry.

### 3.2 Existing Vegetation Communities

The site appears to contain mainly grasslands, saltmarsh/*Juncus* and mangroves communities, from higher elevation to water level respectively. Table 1 lists the areas of each vegetation community on the site.

**Table 1: Vegetation community areas on the Boyters Lane site**

Vegetation type	Area (ha)
Grassland	14.6
Saltmarsh	6.6
<i>Juncus/Schoenoplectus</i> complex	0.7
Mangroves	3.7
Mud Flat	0.3
Open Water	0.5
Teal Lagoon	2.2

The existing mangroves within Teal Lagoon appear to be sourced from the mangroves on the road edge, because of the limited potential for seeds to enter through the small channels in the berm wall. It is also possible that these older mangroves became established after the road was constructed, though before the Teal Berm was erected. There is a possibility that these mangroves could be removed and replanted elsewhere within the northern section of the larger wetland, to reduce the likelihood of mangroves spreading throughout Teal Lagoon over the long-term and thereby reducing waterbird habitat.

The environmental audit carried out by Walker *et. al.*, (2004) found the following plant species present on the site, listed in Table 2.

**Table 2: Plant species recorded by Walker *et. al.* (2004)**

Botanical Name	Common Name
<i>Avicennia marina</i>	Mangrove
<i>Casuarina glauca</i>	Swamp She-Oak
<i>Cotula coronopifolia</i>	Water Buttons
<i>Cynodon dactylon</i>	Bermuda Grass
<i>Cynodon incompletes</i>	Couch
<i>Juncus pallidus</i>	Pale Rush
<i>Juncus</i> sp	Rush
<i>Lythrum salicaria</i>	Purple Loosestrife
<i>Paspalidium</i> sp	
<i>Paspalum dilatatum</i>	Paspalum
<i>Paspalum distichum</i>	Water Couch
<i>Pennisetum clandestinum</i>	Grass
<i>Trifolium</i> spp	Clover (three species)

Further investigations by *Australian Wetlands and Sandpiper Environmental* in July and August produced the additional plant species detailed in Table 3.

**Table 3: Additional plant species recorded in July-August, 2004**

Botanical Name	Common Name
<i>Baccharis halimifolia</i>	Groundsel Bush
<i>Cinnamomum camphora</i>	Camphor Laurel
<i>Conyza sp</i>	Fleabane
<i>Ipomea indica</i>	Morning Glory
<i>Juncus usitatus</i>	Common Rush
<i>Lantana camara</i>	Pink Lantana
<i>Pennisetum clandestinum</i>	Kikuyu Grass
<i>Phragmites australis</i>	Common Reed
<i>Rubus ulmifolius</i>	Blackberry
<i>Schoenoplectus validus</i>	River Clubrush or Great Bulrush
<i>Senecio sp</i>	Fireweed
<i>Triglochin procerum</i>	Water Ribbons
<i>Verbanea sp</i>	Purple Top
Green Tubular Algae	(unidentified)

### 3.3 Fauna and Habitat

A search (Australian Wetlands 2005) was undertaken of the Atlas of NSW Wildlife to obtain historical and recent fauna species records for the locality (5km radius surrounding the subject site). The Atlas search encompassed an area of 100km<sup>2</sup> surrounding the subject site. The search was dated 27 July 2004. The search revealed records for 30 threatened fauna species (refer Plan of Management). Many of the threatened species recorded in the locality are unlikely to utilise the subject site at present. The list of threatened species is indicative of threatened species that may utilise the site if appropriate habitat is provided. For example, revegetation of elevated land with locally endemic fruiting trees would provide habitat for fruit-doves and flying foxes, whilst forested habitat in general would provide a food resource for insectivorous bats and square-tailed kites. Revegetation and rehabilitation of grassland is likely to benefit a wide range of species

A local ornithologist (Mr Ken Shingleton) has been surveying birds on the subject site on a regular basis for the past 12 years. These surveys have provided a good indication of the conservation value of the Boyters Lane Wetland for birds. During the survey period 143 species of bird have been recorded on or near the subject site (refer Plan of Management), including nine species listed on the NSW TSC Act and approximately 47 migratory species listed under the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999.

Threatened species recorded on-site by Mr Shingleton include, blue-billed duck (*Oxyura australis*), black-tailed godwit, black-necked stork, osprey, square-tailed kite and brolga (*Grus rubicunda*). One grass owl (*Tyto capensis*) was recorded on the subject site during field surveys undertaken during the preparation of the management plan. Birds utilise all habitats on the subject site, including the degraded grassland. A number of regionally significant bird species have been recorded on-site, including many inland species that use coastal wetlands as drought refuges. The high diversity of birds recorded at the Boyters Lane wetland indicates that the site represents one of a mosaic of wetland habitats on the Macleay floodplain.

A general fauna habitat assessment was undertaken during the preparation of this plan (Sandpiper Environmental 2004). This assessment identified five broad habitat types. These habitats are likely to be used by a variety of fauna species, including both vertebrates and invertebrates. Areas of dense vegetation, such as the grassland and sedgeland habitats, are used by a variety of small mammals, reptiles and amphibians. The small number of old growth mangroves adjacent to Spencers Creek, along the northern edge of the site, provide potential roosting habitat for insectivorous bats with several small branch and trunk hollows present. Insectivorous bats were recorded foraging over the subject site and grey-headed flying foxes (*Pteropus poliocephalus*) were recorded traversing the site after dusk.

Small ground mammals were also recorded in the saltmarsh and grassland habitats. Many of the faunal species that occur in mangroves and saltmarsh are not confined to these areas alone. They visit the habitats during the tidal cycles or their feeding regimes, whilst also venturing to nearby habitats such as forest or seagrass beds (Saenger, 1994).

Mangroves generally have more fish species inhabiting them on a regular basis than saltmarsh areas, due to the tide heights and length of coverage time. However, mudskippers are among the few species that are found on mudflats, saltmarsh and mangroves alike (Saintilan and Rogers, 2002; Saenger, 1994). Other animals that may utilise or inhabit estuarine wetlands include Grey Kangaroos and Swamp Wallabies, insectivorous bats, spiders, crabs, molluscs, snakes and lizards (Saintilan and Rogers, 2002; Walker, *et. al.*, 2004). During site visits, *Litoria fallax*, the Eastern Dwarf Treefrog, were heard within the *Juncus* plants. Foxes appear to be either recently or currently present on the Boyters Lane site, as burrows were sighted towards the northern end of the Main Berm. Foxes are also known to occur on Pelican Island (Bob Ford, pers. comm.). Dog tracks were also identified during site inspections.

## **4. Vegetation Management Considerations**

### **4.1 Site Issues**

Revegetation activities are unlikely to be successful if site specific issues/conditions are not address. There is a number of issues/consideration that needs to be clarified and addressed in regard to vegetation management of the Boyters Lane site. They include but are not restricted too; stormwater, groundwater, elevation, soils, species selection, planting, proposed infrastructure and maintenance.

#### **4.1.1 Stormwater Run-off**

To address the issue of stormwater management from the proposed playing fields two (2) stormwater wetlands have been constructed. The wetland design principles and vegetation composition was compiled using 'The Constructed Wetlands Manual Vols. 1&2 (DLWC 1998).

#### **4.1.2 Groundwater**

Given the close proximity to an estuarine creek and associated saltmarsh system, the issue of groundwater quality required investigation and clarification. In order to determine the depth and suitability of the groundwater a number of

groundwater test pits were dug and the water quality, with particular reference to salinity, dissolved oxygen, pH level were sampled (refer Walker *et.al.*undated).

#### **4.1.2 Ground Elevation**

The vegetation composition selected for the site will primarily be underpinned by the ground surface elevation and proximity to other environs. A detailed land survey has been undertaken of the site. The survey indicated that the land elevation ranged from 1.2m AHD on the higher ground to 0.24m AHD adjacent to the saltmarsh areas.

#### **4.1.3 Soils**

Refer Sections 3.1.2 and 3.1.3 for site soil descriptions. More detailed soil analysis was undertaken as part of the Boyters Lane Wetland Audit (Walker *et.al.* undated). The vast majority of the Boyters Lane site selected for revegetation has soil described as non saline 'Gleyed Podzolic Soils'. These areas are completely vegetated with some native trees and introduced grasses. Recent planting programs on such soil types within site have indicated no problem with native vegetation establishment. It is expected that the plants selected for this area will have no problems establishing and growing within this soil landscape. In poorly drained fringing areas where revegetation is to occur only species that are suitable for such conditions will be planted (ie Swamp Oak & Melaleuca).

#### **4.1.4 Species Selection**

Only native endemic species are to be planted on site. The objective is to re-establish the area to resemble as close as possible lowland subtropical and swamp forests. In addition, it is intended that vegetation selection reflect the local traditional usage of such areas.

#### **4.1.5 Planting Program**

It is intended that the planting program be undertaken in stages and will be underpinned by funding and seed stock availability. Refer Section 4.3

#### **4.1.6 Proposed Infrastructure**

It is the intention of Kempsey Shire Council to construct an environmentally sensitive educational/interpretative walkway through the re-vegetated areas (Fig 2).

It is proposed that the intended walkway and associated infrastructure works commence after planting/revegetation of relevant areas are completed and vegetation has established.

This strategy has been included has been included to assist in minimizing any disturbance to the wildlife that may occur during the walkway construction.



**Figure 2. proposed walkway layout through revegetation area**

Within the walkway there is proposed to be constructed a number of observation platforms, elevated walkways and a bird hides. The walkway and platforms will be constructed when funding becomes available. As mentioned, initial planting will be undertaken prior to walkway construction however, sufficient passageway will be left unplanted to accommodate walkway construction equipment.

#### **4.1.7 Maintenance**

One of the most difficult tasks associated with revegetation efforts is the required maintenance program. Based on experiences gained from a nearby revegetation site, it is expected that routine maintenance will be required to assist in re-establishment for at least 5 to 10 years. Such maintenance activities included but are not limited to, weed and disease control, replacing dead or diseased tree and possible frost management etc.

Opportunities should be investigated to determine the level of community support for the site and evaluate opportunities to establish a community working group to assist in the maintenance requirement. Also it is expected that Council investigate funding opportunities to assist in this requirement.

## **4.2 Other Issues**

### **4.2.1 Proximity of Houses**

The Boyters Lane site is located wholly within a rural landscape. However, there is urban development on the opposite side of Spencers Creek (refer Fig 2)

### **4.2.2 Grazing**

Prior to purchase of the land by KSC in 2002 the area was used for both beef and dairy cattle grazing. Since the land purchase no cattle grazing has occurred on the site. It is expected that no further cattle grazing will occur in the future.

### **4.2.3 Increase Access**

It is proposed that a pedestrian walkway will be constructed within the re-vegetation zones. By providing this facility, coupled with the development of the adjoining playing fields it is expected there will be a significant increase in the number of local and transient visitors to the site. The increase in human activity raises a number of management issues, including public safety, human movement control, pet control and possible vandalism.

To minimise any adverse effects, access management strategies should be developed. Such strategies should include but not be limited to, constructing the walkway and observation areas to acceptable standards (ie Aust.Standard AS2156.1-2001 Walking Tracks – Classification and Signage), erecting where possible barriers (either constructed and/or planted) to restrict human movement within specified areas and using suitable vandal proof materials.

### **4.2.4 Domestic Animal Management**

The management of domestic animals within the site will be in accordance with the NSW Companion Animal Act & Regulation (1998) and the Kempsey Shire Council Companion Animal Management Plan (2007).

It is expected that signage will be erected informing that all domestic animal are to be under effective control by competent persons.

## **5.0 Rehabilitation Program**

### **5.1 Rehabilitation Objectives**

The fundamental objective is to rehabilitate areas within Boyters Lane site currently dominated by pasture grasses by planting/establishing specific endemic native vegetation species, for the purpose of improved and sustained ecological integrity of the location and provide environmental educational opportunities.

### **5.2 Rehabilitation Proposal**

The rehabilitation proposal is to undertake a staged planting/revegetation program of endemic native trees and shrub species. Species planting selection and location will be determined by obtaining specialist advice and be underpinned by the topographical and hydrological characteristics of each define area.

There are a number of areas within the Boyters Lane site where native vegetation rehabilitation is planned. (Fig.3).

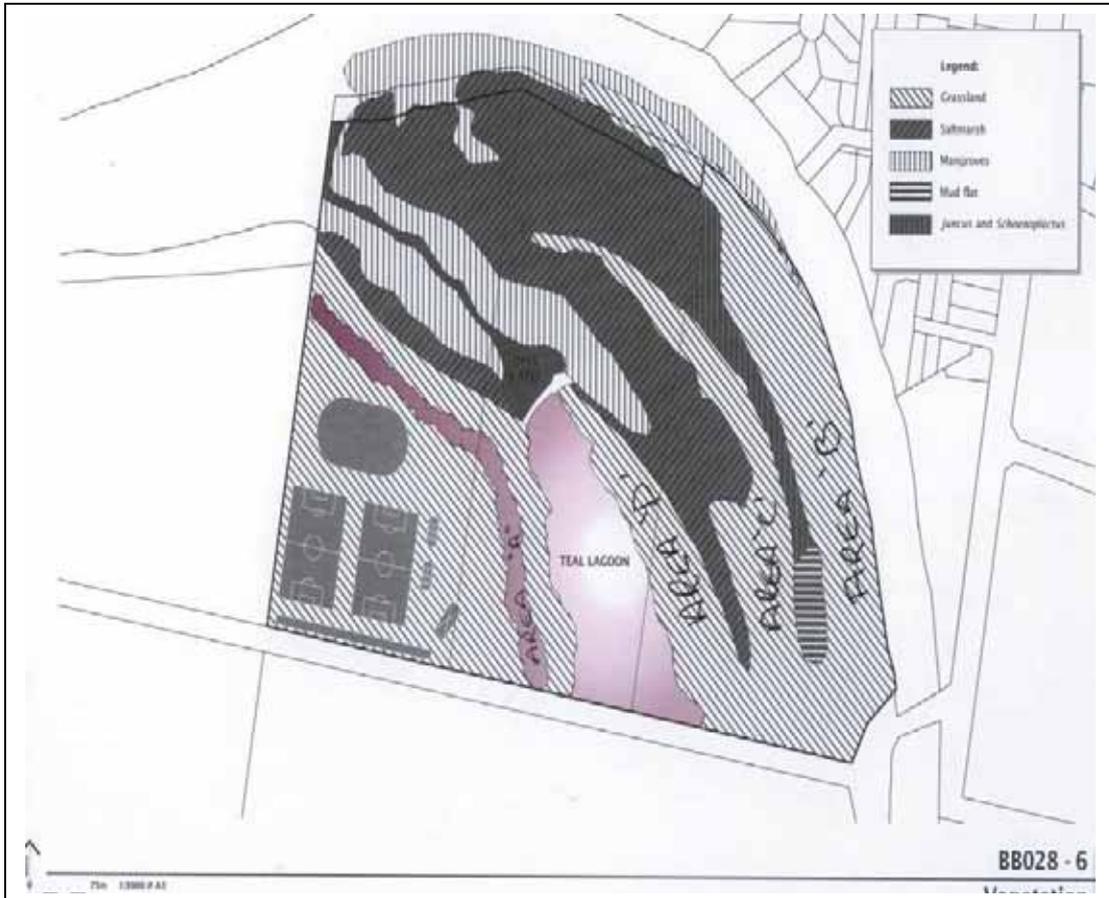


Figure 3. Schematic site diagram showing areas planned for revegetation.

### 5.3.1 Area A – Buffer Zone

The vegetation buffer zone is located on the western side of Teal Lagoon (Fig.4). The purpose of the vegetation buffer zone is to reduce possible impacts on the inhabitants of the wetland from activities of the playing fields (refer PoM). A vegetation buffer zone planting program using similar endemic species to those planned for the revegetation areas has been implemented (Refer Table 2).

It is expected that approximately 3000 trees and shrubs will be planted within the buffer zone. The buffer zone planting schedule has commenced and is planned to be undertaken in four (4) stages.

Stage 1- July 2006 - Completed

Stage 2 – Dec 2006 - Completed

Stage 3 – August 2008 -

Stage 4 – August 2009 (to be restricted to areas north of Stage 2&3 only)

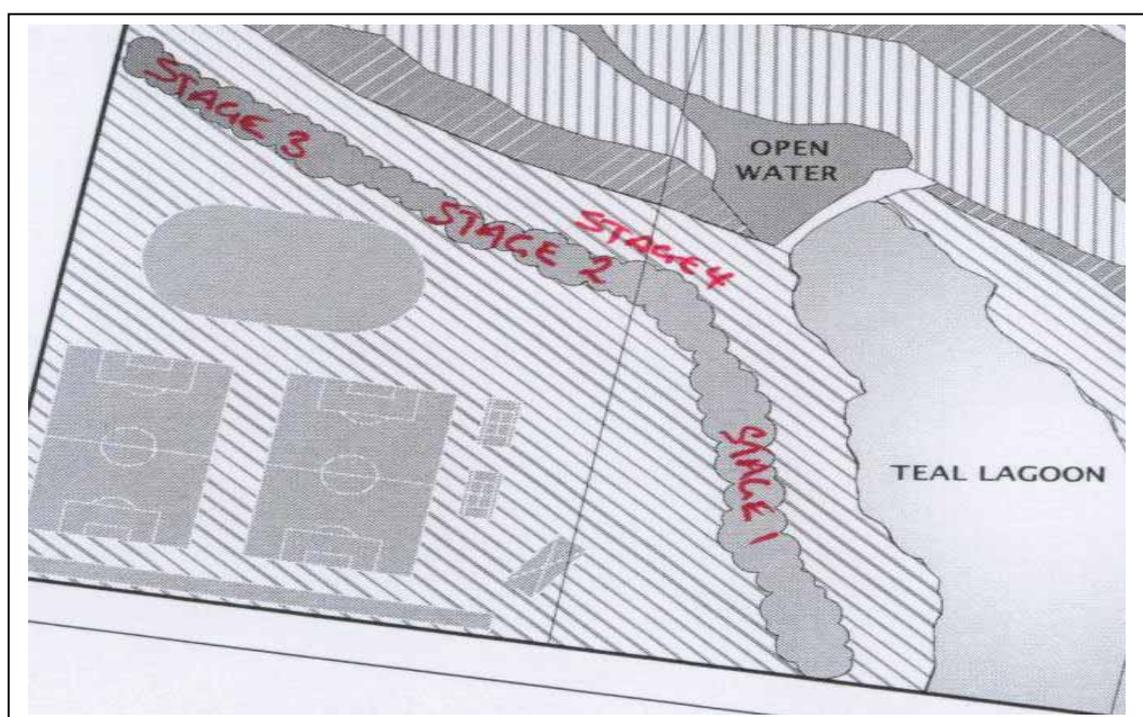


Fig 4. Buffer Zone stage planting locations (note Stage 4 is to be restricted to areas north of Stages 2 & 3 only)

### 5.3.2 Vegetation Selection

The plant species selected for use in the buffer zone areas are locally occurring indigenous plants sourced from local areas. Many of the plant species used are recommended in the Plan of Management and specialist advice. The following table (Table 4) is an indicative inventory of plant species used in the buffer zone areas. Additional species may be added.

Table 4 Buffer zone species inventory

Species Name	Common Name
<i>Acmena smithii</i>	Lilly Pilly
<i>Casurina cunninghamiana</i>	River Sheoak
<i>Casurina glauca</i>	Swamp Oak
<i>Cupaniopsis anacardioides</i>	Tuckeroo
<i>Melaleuca quinquenervia</i>	Paperbark
<i>Ficus coronata</i>	Sandpaper Fig
<i>Ficus rubiginosa</i>	Port Jackson Fig
<i>Eucalyptus robusta</i>	Swamp Mahogany
<i>Waterhousia floribunda</i>	Weeping Lily Pilly
	Lamandra

### 5.3.3 Site Preparation

All zones to be spayed with a glycoside poison to kill the existing kikuyu grass growing over the buffer zone areas. After two (2) weeks the buffer zones are to be rotary hoed prior to planting.

### 5.3.4 Planting Patterns/densities

Tube stocks within the vegetation buffer zone are to be planted in a random manner at a planting rate of approximately one (1) plant per square meter.

### 5.3.5 Pre & Post planting treatment

To ensure the likelihood of a successful planting program, a number of pre & post planting activities are required to be undertaken.

#### 5.3.5.1 Weed Management – Identification

Weeds are plants which, through various methods of distribution and proliferation become a threat to the survival of native plants and animals. The dominant existing vegetation types within Area 'A' are introduced pasture grasses. However, before planting, a weed inspection and identification activity is required to be implemented. It is recommended that Councils Weed Officer and other expert weed identification persons be invited to participate in the inspection.

Based on the outcomes of the weed inspection activity, an appropriate weed control strategy should be implemented.

#### 5.3.5.2 Weed Control

Preliminary site inspections undertaken in Area 'A' indicate that an area specific weed control strategy is required to be implemented for Area 'A' for weed control (pasture grass eradication) prior to and after planting.

##### 5.3.5.2.1 Chemical

A weed control strategy should be implemented using chemicals that are registered for use in such environments. Application should be undertaken using hand held and/or backpack applicators at an application rate recommended by the manufacturers. In addition, the NSW DPI "A Guide to Weed Control In Non-Crop Aquatic and Bushland Situations" 3<sup>rd</sup> Ed, is a recommended source of information.

#### **5.3.5.2.2 Mechanical**

Where chemical application is not suitable (ie for climbing vines over seedlings) a mechanical or physical method is required.

#### **5.3.5.3 Mulching**

Mulching of the buffer zone areas should occur using wood chip materials to a depth of 100mm evenly distributed over the planted area..

#### **5.3.5.4 Understory/ground cover planting**

Selected groundcover and understory plants/shrubs can be planted as part of the initial tall tree planting program. More specific species selection and understory planting activities should be determined and undertaken when the majority of canopy producing trees are well established and an obvious canopy is forming.

## 5.4 Area B – Eastern Elevated Land

### 4.4.1 Timing

August 2008 – September 2008

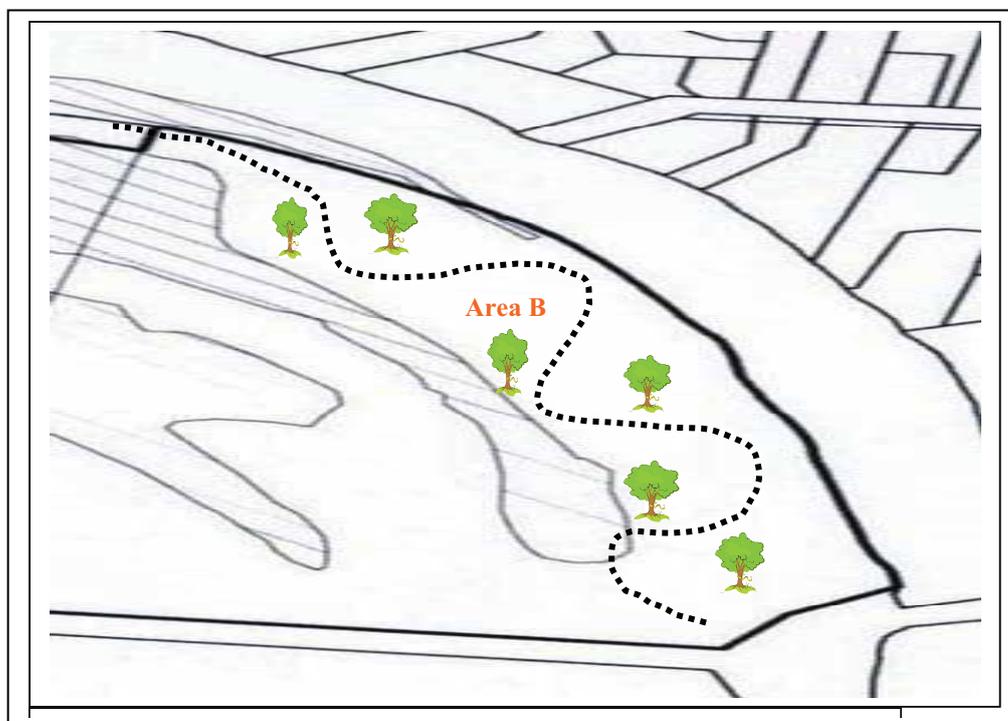


Figure 5. Area B – eastern elevated land – area to be planted

### 5.4.2 Vegetation Selection

The plant species selected for use in the eastern elevated land areas are locally occurring indigenous plants sourced from local areas. Many of the plant species used are recommended in the Plan of Management. The following table is an indicative inventory of plant species to be used in Area B. Additional species may be added.

Table 5 Area B indicative species inventory

Species Name	Common Name
<i>Acmena smithii</i>	Lilly Pilly
<i>Casurina cunninghamiana</i>	River Sheoak
<i>Casurina glauca</i>	Swamp Oak
<i>Cupaniopsis anacardioides</i>	Tuckeroo
<i>Melaleuca quinquenervia</i>	Paperbark
<i>Ficus coronata</i>	Sandpaper Fig
<i>Ficus rubiginosa</i>	Port Jackson Fig
<i>Eucalyptus robusta</i>	Swamp Mahogany
<i>Waterhousia floribunda</i>	Weeping Lily Pilly

### 5.4.3 Site Preparation

There are three (3) basic site preparation options suitable for Area B.

Option 1 – Rotary Hoeing entire area

Option 2 – Linear ripping entire area

Option 3 – Holes dug individually

	Advantages	Disadvantages	Likely Costs	Additional Requirements	Rating
Option -1	Easier planting	Increased weed risk	Moderate to High	Will require significant mulching & weed control	
Option - 2	Easier planting	Linear planting pattern	Moderate	Moderate mulching & weed control	
Option - 3	Minimal ground disturbance	Harder manual planting	Moderate	Moderate mulching & weed control	

#### 5.4.3.1 Preferred option for planting Area B:

##### Option 2

##### Reasons:

Requires less ground disturbance

Planting will be easier

Initial weed control easier

Reduced volumes of mulch required

Planting lines can contour proposed walkway

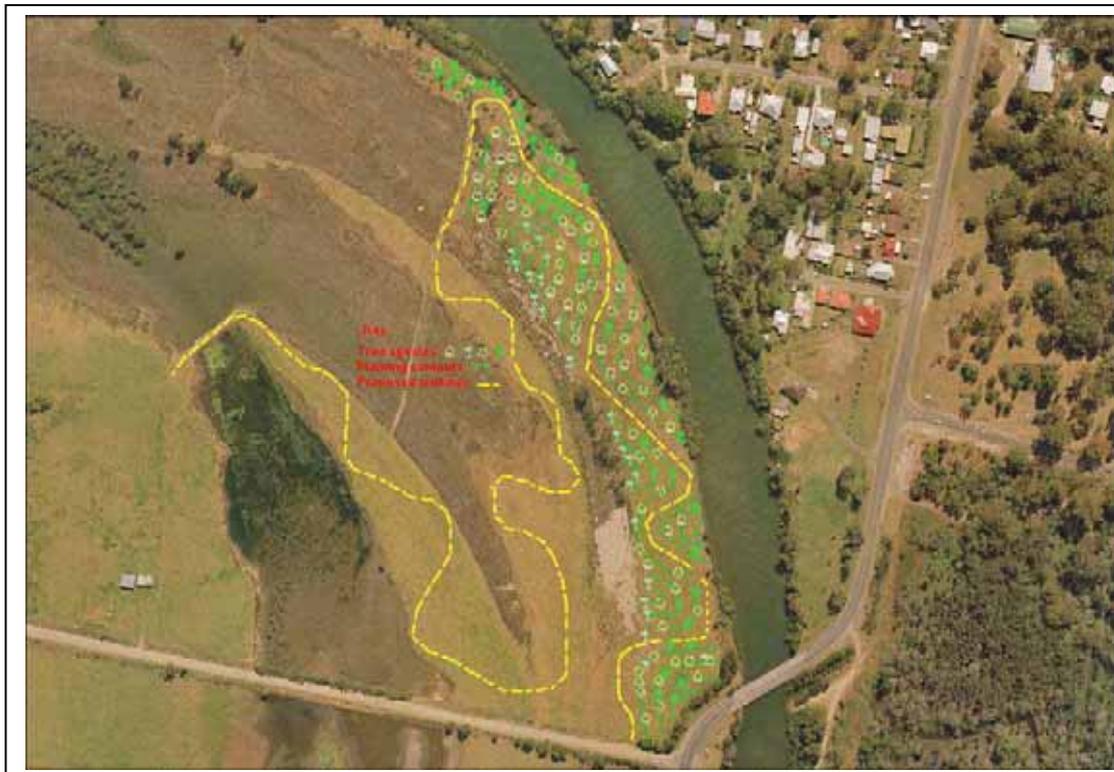


Figure 6 Planting contour layout for Area B

#### **5.4.4 Planting Patterns & Densities**

Before determining planting patterns (ie species clumped together, mixed species evenly/randomly distributed etc) for Area 'B' a review of the overall objectives for the rehabilitation project must be undertaken. As stated the objectives are to;

- 1) Revegetate areas of the Boyters Lane site with native vegetation
- 2) Improve the ecological character of the site
- 3) Improve community environmental awareness

To achieve all three of the objectives with Area 'B' it is recommended that the bulk of the planting pattern should be in clumped or stand arrangements with one dominant species with other selected species randomly planted within or adjacent to the dominant stand.

Initial planting will be excluded from the lineal area defined for the proposed walking track. Planting densities should be around 1 per every 2m<sup>2</sup>. Area 'B' is approximately 2.8 hectares. At a planting rate of approximately 1 per every 3m<sup>2</sup> a total of 9300 trees could be planted within Area 'B'. However, consideration must be given to the area that will not be able to be planted initially due to the required area for the walkway.

##### **5.4.4.1 Theme Planting**

Within Area 'B' as a component of the planting pattern and species selection, consideration is to be given to what possible themes and or education arrangement could be established.

##### **5.4.4.2 Bush Tucker / Indigenous Use**

Wetland and coastal floodplain traditionally provided a source of food and materials for indigenous communities. To reflect the local traditional usage of the area, planting should include those species that reflect the pre-European natural surrounding and those that provided food, shelter and materials for the local indigenous communities. A list of bush food plants suitable for planting on the Boyters Lane site is provided in the Boyters Lane Wetlands Environmental Education Plan 2007.

##### **5.4.4.2 Non-indigenous Heritage and Use**

Wetland and coastal floodplain have also traditionally provided a source of food and materials for non-indigenous communities such as timber and farming industries. Within Area 'B' there could be an opportunity to plant endemic species that could highlight non-indigenous use of such landscapes.

##### **5.4.4.3 Ecological Importance**

Coastal floodplains and estuarine wetlands perform a variety of important environmental functions. The Boyters Lane Wetland can provide an accessible site for visitors to gain an introduction and understanding of the ecological importance of these environments. The planting strategy should include where possible should utilize the location of the proposed walking trail to highlight such considerations.

#### **5.4.5 Pre & Post Planting Treatment**

To ensure the likelihood of a successful planting program, a number of pre & post planting activities are required to be undertaken.

#### **5.4.5.1 Weed Management – Identification**

There are a number of different woody, herbaceous and scrambling weeds growing within Area B of the Boyters Lane site. They include; Morning Glory, Fireweed, Privet etc. Before planting, a weed inspection and identification activity is required to be implemented. It is recommended that Councils Weed Officer and other expert weed identification person be invited to participate in the inspection.

Based on the outcomes of the weed inspection activity, an appropriate weed control strategy should be implemented.

#### **5.4.5.2 Weed Control**

Preliminary site inspections undertaken in Area 'A' indicate that an area specific weed control strategy is required to be implemented for Area 'A' for weed control prior to and after planting.

##### **5.4.5.2.1 Chemical**

A weed control strategy should be implemented using chemicals that are registered for use in such environments. Application should be undertaken using hand held and/or backpack applicators at an application rate recommended by the manufacturers. In addition, the NSW DPI "*A Guide to Weed Control In Non-Crop Aquatic and Bushland Situations* ' 3<sup>rd</sup> Ed, is a recommended source of information.

##### **5.4.5.2.2 Mechanical**

Where chemical application is not suitable (ie for climbing vines over seedlings) a mechanical or physical method is required.

##### **5.4.5.3 Mulching**

Mulching of the buffer zone areas should occur using wood chip materials to a depth of 100mm evenly distributed over the planted area.

##### **5.4.5.4 Understory/ground cover planting**

Selected groundcover and understory plants/shrubs can be planted as part of the initial tall tree planting program. More specific species selection and understory planting activities should be determined and undertaken when the majority of canopy producing trees are well established and an obvious canopy is forming.

## 5.5 Area C – Central Elevated Land

### 5.5.1 Timing

September 2008 – August 2009

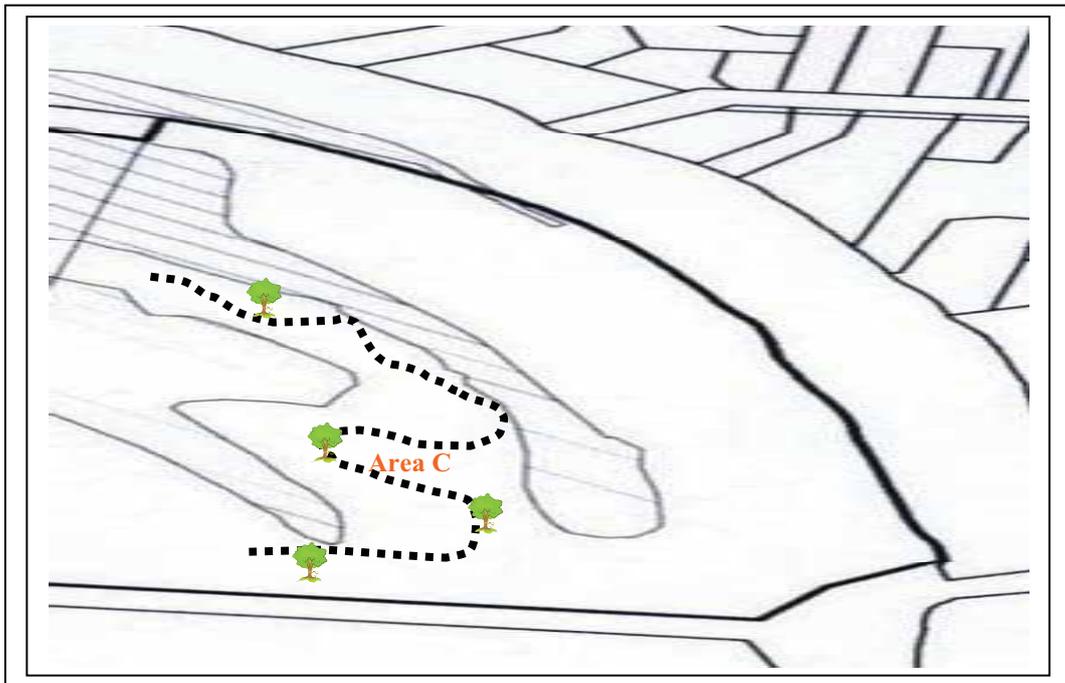


Figure 7. Area C – eastern elevated land – area to be planted

### 5.5.2 Vegetation Selection

The plant species selected for use in the central elevated land areas are locally occurring indigenous plants sourced from local areas. Many of the plant species used are recommended in the Plan of Management. The following table is an indicative inventory of plant species used in Area C. Others may be added.

Table xx Area C species inventory

Species Name	Common Name
<i>Acmena smithii</i>	Lilly Pilly
<i>Casurina cunninghamiana</i>	River Sheoak
<i>Casurina glauca</i>	Swamp Oak
<i>Cupaniopsis anacardioides</i>	Tuckeroo
<i>Melaleuca quinquenervia</i>	Paperbark
<i>Ficus coronata</i>	Sandpaper Fig
<i>Ficus rubiginosa</i>	Port Jackson Fig
<i>Eucalyptus robusta</i>	Swamp Mahogany
<i>Waterhousia floribunda</i>	Weeping Lily Pilly

### 5.5.3 Site Preparation

. There are three (3) basic site preparation options suitable for Area C.

Option 1 – Rotary Hoeing

Option 2 – Linear ripping

Option 3 – Holes dug individually

	Advantages	Disadvantages	Likely Costs	Additional Requirements	Rating
Option -1	Easier planting	Increased weed risk	Moderate to High	Will require significant mulching & weed control	
Option - 2	Easier planting	Linear planting pattern	Moderate	Moderate mulching & weed control	
Option - 3	Minimal ground disturbance	Harder manual planting	Moderate		

#### 5.5.3.1 Preferred option for planting Area C:

##### Option 2

##### Reasons:

Requires less ground disturbance

Planting will be easier

Initial weed control easier

Reduced volumes of mulch required



Figure 8. Planting contour layout for Area C

## **5.5.4 Planting Patterns & Densities**

As within Area 'B' as a component of the planting pattern and species selection within Area 'C', consideration is to be given to what possible themes and or education arrangement could be established.

### **5.5.4.1 Theme Planting**

Within Area 'C' as a component of the planting pattern and species selection, consideration is to be given to what possible themes and or education arrangement could be established.

### **5.5.4.2 Bush Tucker / Indigenous Use**

Wetland and coastal floodplain traditionally provided a source of food and materials for indigenous communities. To reflect the local traditional usage of the area, planting should include those species that reflect the pre-European natural surrounding and those that provided food, shelter and materials for the local indigenous communities. A list of bush food plants suitable for planting on the Boyters Lane site is provided in the Boyters Lane Wetlands Environmental Education Plan 2007.

### **5.5.4.2 Non-indigenous Heritage and Use**

Wetland and coastal floodplain have also traditionally provided a source of food and materials for non-indigenous communities such as timber and farming industries. Within Area 'B' there could be an opportunity to plant endemic species that could highlight non-indigenous use of such landscapes.

### **5.5.4.3 Ecological Importance**

Coastal floodplains and estuarine wetlands perform a variety of important environmental functions. The Boyters Lane Wetland can provide an accessible site for visitors to gain an introduction and understanding of the ecological importance of these environments. The planting strategy should include where possible should utilize the location of the proposed walking trail to highlight such considerations.

## **5.5.5 Pre & Post Planting Treatment**

To ensure the likelihood of a successful planting program, a number of pre & post planting activities are required to be undertaken.

### **5.5.5.1 Weed Management – Identification**

Weeds are plants which, through various methods of distribution and proliferation become a threat to the survival of native plants and animals. There are a number of different woody, herbaceous and scrambling weeds growing within the Boyters Lane site. They include; Morning Glory, Fireweed, Privet etc. Before planting occurs a weed inspection and identification activity is required to be implemented. It is recommended that Councils Weed Officer and other expert weed identification person be invited to participate in the inspection.

Based on the outcomes of the weed inspection activity, an appropriate weed control strategy should be implemented.

### **5.5.5.2 Weed Control**

Preliminary site inspections undertaken in Area 'A' indicate that an area specific weed control strategy is required to be implemented for Area 'A' for weed control prior to and after planting.

#### **5.5.5.2.1 Chemical**

A weed control strategy should be implemented using chemicals that are registered for use in such environments. Application should be undertaken using hand held and/or backpack applicators at an application rate recommended by the manufacturers. In addition, the NSW DPI "*A Guide to Weed Control In Non-Crop Aquatic and Bushland Situations* ' 3<sup>rd</sup> Ed, is a recommended source of information.

#### **5.5.5.2.2 Mechanical**

Where chemical application is not suitable (ie for climbing vines over seedlings) a mechanical or physical method is required.

#### **5.5.5.3 Mulching**

Mulching of the buffer zone areas should occur using wood chip materials to a depth of 100mm evenly distributed over the planted area.

#### **5.5.5.4 Understory/ground cover planting**

Selected groundcover and understory plants/shrubs can be planted as part of the initial tall tree planting program. More specific species selection and understory planting activities should be determined and undertaken when the majority of canopy producing trees are well established and an obvious canopy is forming.

## 5.6 Area D – Western Elevated Land

### 5.6.1 Timing

September 2009 – August 2010

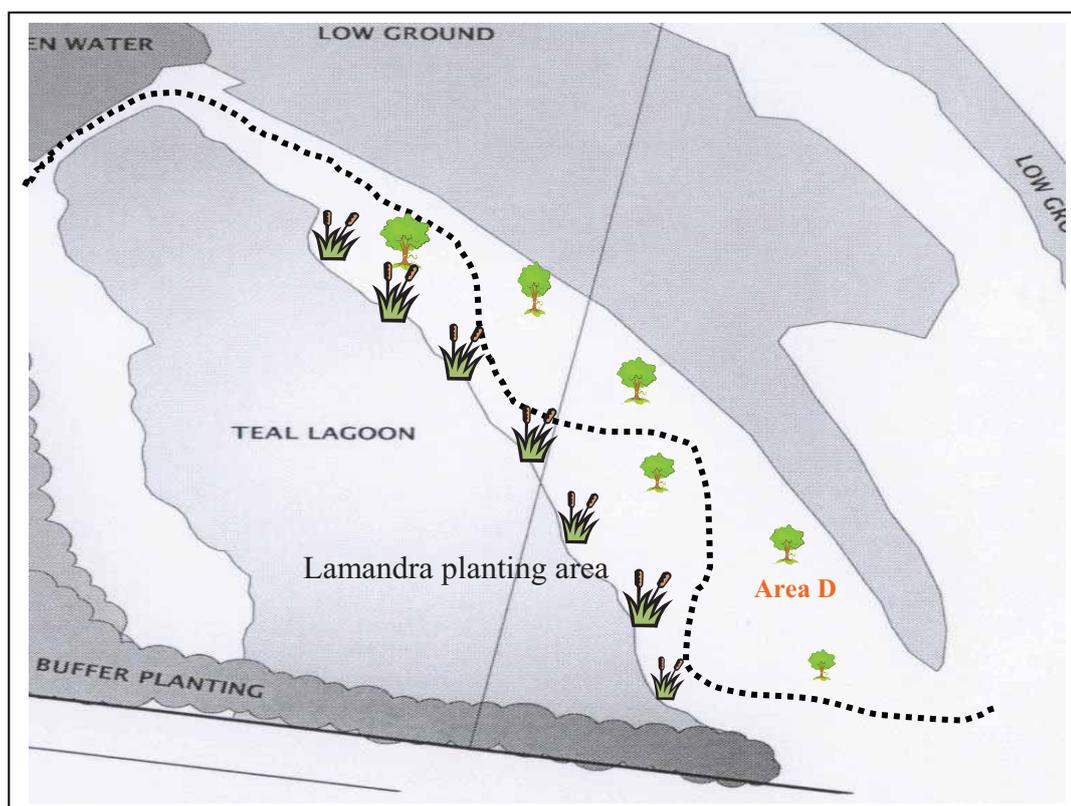


Figure 9. Area D- western elevated land – area to be planted

### 5.6.2 Vegetation Selection

The plant species selected for use in the western elevated land areas are locally occurring indigenous plants sourced from local areas. Many of the plant species used are recommended in the Plan of Management. The following table is an indicative inventory of plant species used in Area D. Additional species may be added.

Table xx Area D species inventory

Species Name	Common Name
<i>Acmena smithii</i>	Lilly Pilly
<i>Casurina cunninghamiana</i>	River Sheoak
<i>Casurina glauca</i>	Swamp Oak
<i>Cupaniopsis anacardioides</i>	Tuckeroo
<i>Melaleuca quinquenervia</i>	Paperbark
<i>Ficus coronata</i>	Sandpaper Fig
<i>Ficus rubiginosa</i>	Port Jackson Fig
<i>Eucalyptus robusta</i>	Swamp Mahogany
<i>Waterhousia floribunda</i>	Weeping Lily Pilly
	Lamandra

### 5.6.3 Site Preparation

There are three (3) basic site preparation options suitable for Area D.

Option 1 – Rotary Hoeing

Option 2 – Linear ripping

Option 3 – Holes dug individually

	Advantages	Disadvantages	Likely Costs	Additional Requirements	Rating
Option -1	Easier planting	Increased weed risk	Moderate to High	Will require significant mulching & weed control	
Option - 2	Easier planting	Linear planting pattern	Moderate	Moderate mulching & weed control	
Option - 3	Minimal ground disturbance	Harder manual planting	Moderate		

#### 5.6.3.1 Preferred option for planting Area D:

##### Option 2

##### Reasons:

Requires less ground disturbance

Planting will be easier

Initial weed control easier

Reduced volumes of mulch required

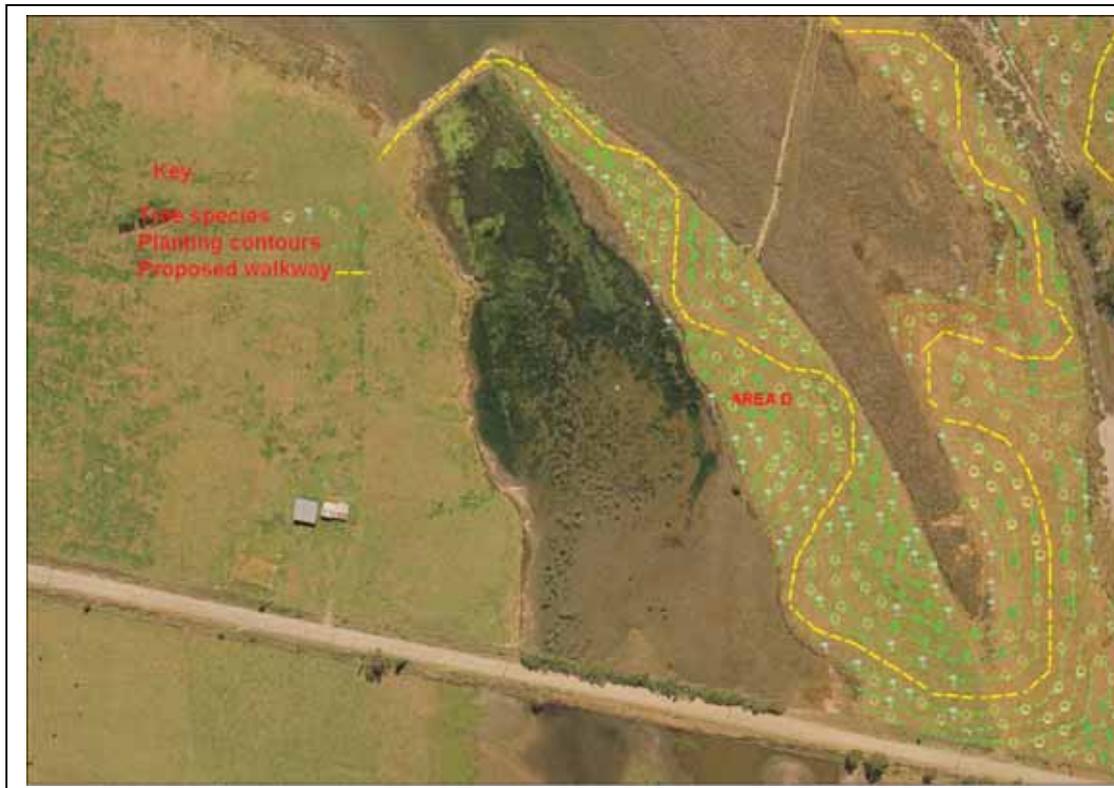


Figure 10. Planting contour layout for Area D

## **5.6.4 Planting Patterns & Densities**

The western edge of Area D, strip approximately 10m wide is to be planted Lamandras to provide a visual sighting requirement for wading birds within Teal Lagoon. Initial planting will be excluded from the lineal area defined for the proposed walking track.

### **5.6.4.1 Theme Planting**

Within Area 'D' as a component of the planting pattern and species selection, consideration is to be given to what possible themes and or education arrangement could be established.

### **5.6.4.2 Bush Tucker / Indigenous Use**

Wetland and coastal floodplain traditionally provided a source of food and materials for indigenous communities. To reflect the local traditional usage of the area, planting should include those species that reflect the pre-European natural surrounding and those that provided food, shelter and materials for the local indigenous communities. A list of bush food plants suitable for planting on the Boyters Lane site is provided in the Boyters Lane Wetlands Environmental Education Plan 2007.

### **5.6.4.2 Non-indigenous Heritage and Use**

Wetland and coastal floodplain have also traditionally provided a source of food and materials for non-indigenous communities such as timber and farming industries. Within Area 'B' there could be an opportunity to plant endemic species that could highlight non-indigenous use of such landscapes.

### **5.6.4.3 Ecological Importance**

Coastal floodplains and estuarine wetlands perform a variety of important environmental functions. The Boyters Lane Wetland can provide an accessible site for visitors to gain an introduction and understanding of the ecological importance of these environments. The planting strategy should include where possible should utilize the location of the proposed walking trail to highlight such considerations.

## **5.6.5 Pre & Post Planting Treatment**

To ensure the likelihood of a successful planting program, a number of pre & post planting activities are required to be undertaken.

### **5.5.5.1 Weed Management – Identification**

Weeds are plants which, through various methods of distribution and proliferation become a threat to the survival of native plants and animals. There are a number of different woody, herbaceous and scrambling weeds growing within the Boyters Lane site. They include; Morning Glory, Fireweed, Privet etc. Before planting occurs a weed inspection and identification activity is required to be implemented. It is recommended that Councils Weed Officer and other expert weed identification person be invited to participate in the inspection.

Based on the outcomes of the weed inspection activity, an appropriate weed control strategy should be implemented.

### **5.5.5.2 Weed Control**

Preliminary site inspections undertaken in Area 'A' indicate that an area specific weed control strategy is required to be implemented for Area 'A' for weed control prior to and after planting.

#### **5.5.5.2.1 Chemical**

A weed control strategy should be implemented using chemicals that are registered for use in such environments. Application should be undertaken using hand held and/or backpack applicators at an application rate recommended by the manufacturers. In addition, the NSW DPI "*A Guide to Weed Control In Non-Crop Aquatic and Bushland Situations* ' 3<sup>rd</sup> Ed, is a recommended source of information.

#### **5.5.5.2.2 Mechanical**

Where chemical application is not suitable (ie for climbing vines over seedlings) a mechanical or physical method is required.

#### **5.5.5.3 Mulching**

Mulching of the buffer zone areas should occur using wood chip materials to a depth of 100mm evenly distributed over the planted area.

#### **5.5.5.4 Understorey/ground cover planting**

Selected groundcover and understorey plants/shrubs can be planted as part of the initial tall tree planting program. More specific species selection and understorey planting activities should be determined and undertaken when the majority of canopy producing trees are well established and an obvious canopy is forming.

### **5.6 Seed Collection and Propagation**

It is expected that all vegetation that is to be planted will be provided/sourced from local nurseries.

### **5.7 Protection of Remnant Vegetation**

Within the Boyters Lane site is very little large-medium woody trees remnants left standing. However, there are two small stands located on the eastern elevated land area. No large-medium or small trees are to be disturbed during any stages of the rehabilitation project, unless they are deemed to be either a weed species and/or introduced exotics.

## **6.0 Mangrove, Saltmarsh & Grass Areas**

Within the Boyters Lane landscape relevant to this Vegetation Plan there exists a number of mangrove, saltmarsh and grassland communities. The following

sections describe the management options for these community types based on the best information available at the time of producing this plan.

## **6.1 Mangrove Areas**

The Boyters Lane Playing field & Wetland Plan of Management (2005) identified 3.7ha of the area is mangrove community. The dominant mangrove species is *Avicennia marina*. There are basically two (2) major mangrove areas that exist within the revegetation site landscape, 1) along the Spencers Creek river bank and 2) within the estuarine mud flats or embayment areas. A third less significant (in extent) stand of mangroves is located within Teal Lagoon.

### **6.1.1 Riverbank Mangroves**

Except in locations where observation platforms are constructed, where possible recolonisation and protection of mangroves growing along the river should be supported. It is expected that full recolonisation of mangroves in the location should occur to natural processes. Efforts should be made to discourage any human activity within and/or along the river that will impact on mangrove establishment and development. The ecological value of the mangrove communities can be described and presented as a component of the environmental awareness/education program developed for the site.

### **6.1.2 Riverbank Weed Management**

Currently, there is evidence that a number of introduced weed species (ie Morning Glory, Blackberry etc) have established along the riverbank and are growing within and over mangroves. To eradicate the current infestation and control possible future outbreaks, an on-going river bank weed management program should be developed.

A weed control strategy should be implemented using chemicals that are registered for use in such environments. The NSW DPI "*A Guide to Weed Control In Non-Crop Aquatic and Bushland Situations* ' 3<sup>rd</sup> Ed, is a recommended source of information. Where chemical application is not suitable (ie for climbing vines over seedlings) a mechanical or physical method is required.

### **6.1.3 Estuarine Mud Flats/Embayment's**

Anecdotal evidence has suggested that since the removal of cattle from the area, mangrove proliferation over the estuarine mud flat areas have resulted. Concerns have been raised that mangrove dominance of these areas is possibly reducing the ecological integrity of the estuarine mud flats and encroaching on saltmarsh areas. It is proposed that until specific investigations and further research into the effects of mangrove proliferation with the Boyters Lane site is undertaken, that no specific management strategy be developed and implemented to address this issue.

### **6.1.4 Teal Lagoon Mangroves**

Within Teal Lagoon a number of mangrove stands have established. The Boyters Lane Playing Fields and Wetlands PoM (2005) highlighted an issue pertaining to the colonisation of Teal lagoon by mangroves. It is proposed that no

activity related to mangrove management in Teal Lagoon is to be undertaken until further more in depth and detailed assessments are undertaken.

## 6.2 Saltmarsh Areas

The Boyters Lane Playing field & Wetland Plan of Management (2005) identified 6.6ha of the area is saltmarsh community and 0.7ha Juncus/Schoenoplectus complex. The saltmarsh area is dominated by *Juncus usitatus* (Common Rush), *Juncus pallidus* (Pale Rush) and *Juncus sp.* There are two (2) primary saltmarsh management areas. They include the area adjacent to Area 'A' and the area adjacent to Areas 'B', 'C' and 'D'.

### 6.2.1 Saltmarsh Area 'A'

The saltmarsh area is adjacent to north of Area 'A'. The Boyters Lane Playing Fields & Wetlands Plan of Management (2005) discusses possible saltmarsh management options.



Figure.11. Saltmarsh area adjacent to Area 'A'.

Currently, this saltmarsh area is under threat of being colonised completely by mangroves. Given the protective management status of Coastal Saltmarsh communities, consideration should be given to undertake future investigative strategies that will ensure the sustainability and ecological integrity of this saltmarsh area.

### 6.2.2 Saltmarsh Areas 'B', 'C', and 'D'.

The saltmarsh area adjacent to Areas 'B', 'C' and 'D' represents the vast majority of saltmarsh area on the project site.



**Figure 12. Saltmarsh communities adjacent to Areas 'B', 'C' & 'D'**

The saltmarsh communities adjacent to Areas B,C, & D appear to be basically intact and ecologically sound. The management of this landscape should be underpinned by developing strategies that protected the ecological status and integrity of the area.

### **6.3 Grassland Areas C.**

In the northern section of Area C, an area of 2,432km<sup>2</sup> is to remain unplanted and in its current condition of a kikuyu grassed area.



**Figure 13 Northern area of Area C to remain unplanted for the purpose of Grass Owls.**

## **7.0 Targets**

Project targets should be set to achieve specific goals and objectives.

### **7.1 Revegetation Targets**

The revegetation targets are in general terms, targets measured by the total area of successful revegetation on the project site of native trees and shrubs.

The primary revegetation target is to have all areas identified within the BLVMP established and functioning as a healthy self sustained ecosystem.

### **7.2 Infrastructure Targets**

The primary infrastructure targets are to have constructed within the area defined by the BLVMP, a low maintenance wheel chair friendly pedestrian walkway with additional interaction / observation areas and facilities (ie bird hides).

### **7.3 Ecological Targets**

The primary ecological target is to have all areas identified within the BLVMP established and functioning as a healthy and diverse self sustained ecosystem.

### **7.4 Educational Targets**

By 2015 the Boyters Lane site will provide an environmental educational /awareness facility that adequately caters for the use by educational institutions, the broader local and transient communities.

## 8.0 References

Australian Wetland (2005). Boyters Lane Playing Fields and Wetlands Plan of Management. Prepared for Kempsey Shire Council.

Ensby, R., & Johnson, A. (2007) 3<sup>rd</sup> Ed. Noxious and Environmental Weed Control Handbook, *A Guide To Weed Control In Non-Crop Aquatic and Bushland Situation*, NSW DPI.

Walker, G., Broomhead, B., & Kinsela, A., (undated) Boyters Lane Wetland Audit, ANU.

