JAMES WARREN & Associates Pty Ltd

ENVIRONMENTAL CONSULTANTS

# RISE ESTATE
# BILAMBIL HEIGHTS WEST TWEED
# MP 08-0234

## VOLUME 3 – SITE REHABILITATION AND PEST MANAGEMENT PLAN

JULY 2009

REPORT PREPARED FOR
TERRANORA GROUP MANAGEMENT PTY LTD

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# 1. INTRODUCTION

## 1.1 Background

James Warren & Associates (JWA) have been engaged by Terranora Group Management Pty Ltd to prepare a Site Rehabilitation and Pest Management Plan for conservation areas within the RISE Estate, Bilambil Heights. A Development Application for a resort and golf course was approved for the site in 1998, which covered a large portion of the site. DA approval allowed for extensive rehabilitation of sub-tropical rainforest remnants including removal of dense infestations of Camphor laurel and translocation and regeneration of threatened plant species.

Between 2004 and 2006 the landowner implemented a program of Camphor laurel removal with a view to regenerating native subtropical rainforest, including threatened plant species.

In 2006, a fresh application was lodged with the NSW Department of Planning. As part of the proposed development of the site, approximately 85 hectares (46% of the site) will be conserved and dedicated to conservation. The vegetation areas to be conserved will be rehabilitated by way of weed removal and subsequent planting with endemic subtropical rainforest species (including extensive replanting of threatened species).

The Minister for Planning has authorised a Concept Plan for the proposed Rise residential community at Bilambil Heights and subsequently, the Director General's Environmental Assessment Requirements (DGEARs) were issued to Terranora Group Management Pty Ltd.

## 1.2 Objectives

This plan and associated documents (i.e. Volumes 1 – 2) have been prepared in response to the DGEARs.

The objectives of this management plan are to:

- Provide a plan for the revegetation and regeneration of the development site;
- To offset the removal of any Endangered Ecological Communities (EEC's), Threatened flora species, and habitat for Threatened flora and fauna species, to ensure no net loss as a result of the development;
- Identify areas of retained vegetation that will be maintained through weed control and general maintenance;
- Identify areas that will be rehabilitated using natural regeneration or enhancement plantings;
- Provide management guidelines for the revegetation, natural regeneration and weed control to be implemented;
- Outline a maintenance and monitoring program for the site;

- Provide management guidelines for pest animal species that may occur on the site; and
- Provide management guidelines for the on-going conservation of vegetation on the site.

## 1.3 Scope

This plan refers to management and rehabilitation of the MP08-0234 component of the RISE development. It should be noted that further rehabilitation works (approximately 45.2ha) are planned within the balance area of the subject site. Details of additional rehabilitation within the balance area are outlined in **ANNEXURE 1**.

A summary of the total proposed rehabilitation works is provided in **TABLES 1.1 & 1.2**.

**TABLE 1.1**
**SUMMARY OF IMPACT & OFFSETS FOR NATIVE VEGETATION COMMUNITIES ON THE SUBJECT SITE**

| VEGETATION | TOTAL AREA (ha) | LOSSES | | | | | RETAINED | OFFSETS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LOSS - MP08-0234 Dev. (ha) | LOSS - MP08-0234 Sports Field (ha) | LOSS - MP08-0234 Spine Rd (ha) | LOSS - Balance Area (ha) | TOTAL LOSS (ha) | TOTAL RETAINED (ha) | PROPOSED OFFSETS - MP08-0234 (ha) | PROPOSED OFFSETS - Balance Area (ha) | Total Area at completion of Development (ha)*# | Net Loss/Gain (ha) *^ |
| Community 1 | 27.32 | 0.00 | 0.00 | 0.33 | 0.00 | 0.33 | 26.98 | 4.17 | 28.39 | 76.59 | 27.6 |
| Community 2 | 17.13 | 2.62 | 0.00 | 0.00 | 0.00 | 2.62 | 14.51 | | | | |
| Community 3 | 0.35 | 0.35 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | | | | |
| Community 4 | 4.13 | 1.59 | 0.00 | 0.00 | 0.00 | 1.59 | 2.54 | | | | |
| **TOTAL** | **188.16** | **87.26** | **4.44** | **7.66** | **0.00** | **99.36** | **88.80** | **4.17** | **28.39** | **49.61** | **28.35** |
| **TOTAL %** | **100.00** | **46.37** | **2.36** | **4.07** | **0.00** | **52.80** | **47.20** | ~ | ~ | ~ | ~ |

* Calculations of net loss/gain have only considered native vegetation communities (i.e. grassland, landscaping, dams and existing infrastructure have not been included)

# Total area at development completion has been calculated as follows = Area to be retained + Proposed offsets.

^ Net Loss/Gain has been calculated as follows = Total area at development completion - Total area (original area prior to construction).

**TABLE 1.2**
**SUMMARY OF IMPACT & OFFSETS FOR ENDANGERED ECOLOGICAL COMMUNITIES ON THE SUBJECT SITE**

| EEC | TOTAL AREA (ha) | LOSSES | | | | RETAINED | OFFSETS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | LOSS - MP08-0234 Development (ha) | LOSS - MP08-0234 Sports Field (ha) | LOSS - MP08-0234 Spine Rd (ha) | TOTAL LOSS (ha) | TOTAL RETAINED (ha) | PROPOSED OFFSETS - MP08-0234 (ha) | PROPOSED OFFSETS - BALANCE AREA (ha) | Total Area at completion of Development (ha) *# | Net Loss/Gain (ha) *^ |
| Lowland Rainforest | 17.13 | 2.62 (15.3%) | 0.00 | 0.00 | 2.62 (15.3%) | 14.51 | 4.17 | 28.39 | 32.56 | 11.31 |
| Regenerating Lowland Rainforest | 4.13 | 1.59 (38.5%) | 0.00 | 0.00 | 1.59 (38.5%) | 2.54 | | | | |
| **TOTAL** | **21.26** | **4.21** | **0.00** | **0.00** | **4.21** | **17.05** | **4.17** | **28.39** | **32.56** | **11.31** |
| **TOTAL %** | **100** | **19.8** | **0.00** | **0.00** | **19.8** | **80.2** | ~ | ~ | ~ | ~ |

* Calculations of net loss/gain have only considered native vegetation communities (i.e. grassland, landscaping, dams and existing infrastructure have not been included)

# Total area at development completion has been calculated as follows = Area to be retained + Proposed offsets.

^ Net Loss/Gain has been calculated as follows = Total area at development completion - Total area (original area prior to construction).

## 1.4 The Subject Site

The Subject site consists of the Terranora Golf Resort and associated grazing land and covers a total area of approximately 188ha. The proposed development covers a total area of approximately 129ha. While much of the land is cleared or has been substantially modified, patches of regrowth native vegetation occur covering approximately 68.4ha, including a large area of rainforest in the south-west of the site. The majority of native vegetation on the site however is heavily infested with weeds including Camphor laurel and Privet. An aerial photograph of the subject site is shown in **FIGURE 1**.

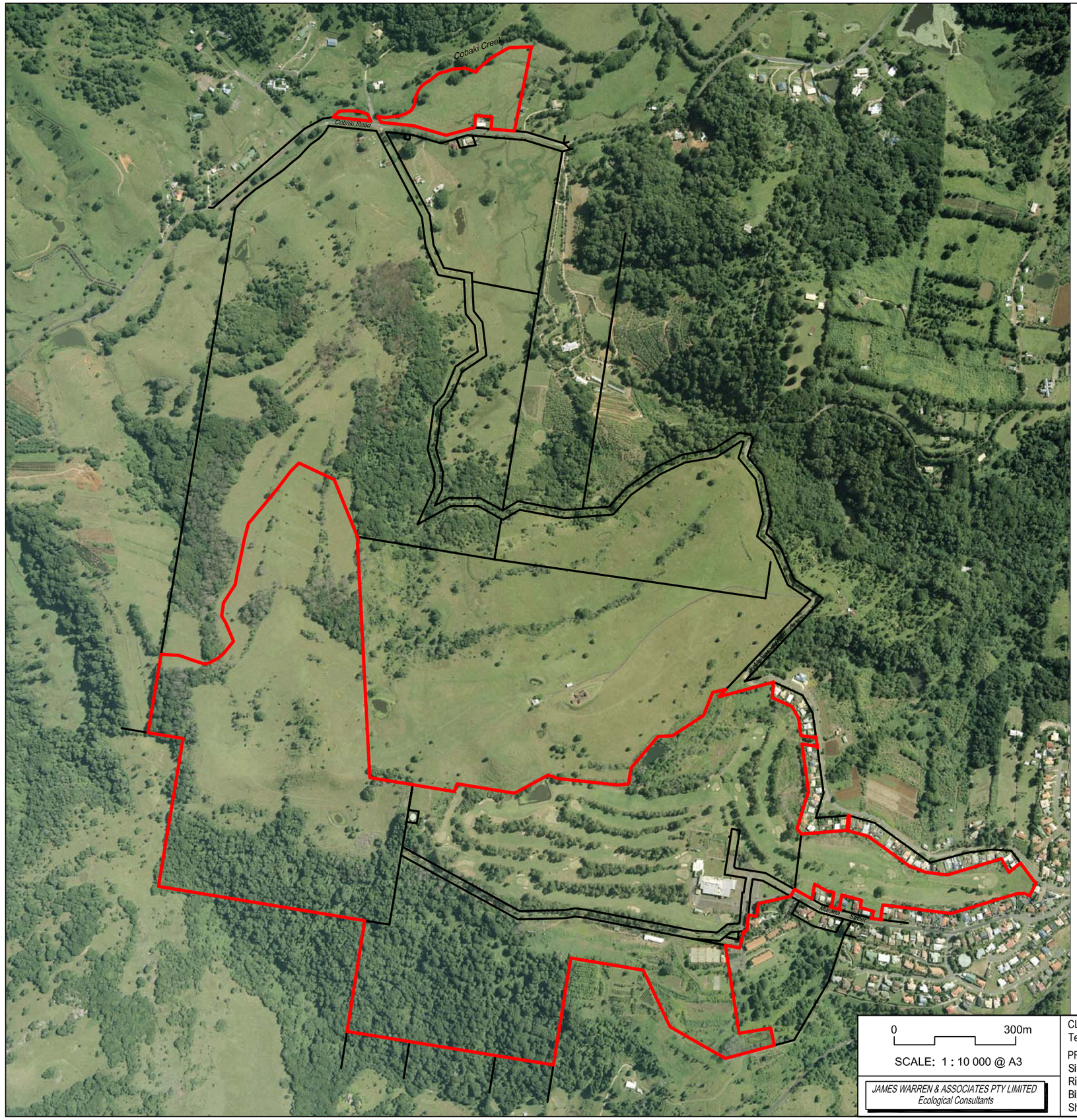
The site undulates from 3m AHD in the low-lying northern portion to 216m AHD in the central and southern portions of the site and includes steeply sloping land.

## 1.5 The proposed development

The site is proposed to be developed into a master planned residential community. A concept plan for the area applicable to the MP08-0234 application is shown in **FIGURE 2**. The MP08-0234 application will include the following:

- Precinct A - Village centre (6.0 hectares);
- Precinct B – Retirement living (6.81 hectares);
- Precinct C – Existing water reservoir (0.48 hectares);
- Precinct D – Low density housing (10.18 hectares);
- Precinct E – Low density housing (5.52 hectares);
- Precinct F – Nursing home (1.15 hectares);
- Precinct G – Retirement living (5.93 hectares);
- Precinct H – Medium density housing (4.03 hectares);
- Precinct I – Private schools (4.26 hectares);
- Precinct J – Residential (2.01 hectares);
- Precinct K – Reservoir (0.2 hectares);
- Precinct L – Hilltop village (14.98 hectares);
- Precinct M – Retirement living (5.79 hectares);
- Precinct N – Residential (11.55 hectares);
- Precinct O – Hillside residential (2.35 hectares);
- Precinct U – Unstructured Sports Park(4.54 hectares); and
- Precinct V – Open Space and Conservation (37.12 hectares).

The MP08-0234 application includes the creation of an estimated 1804 dwellings and will also include the construction of the 'Spine Road' which will link the elevated southern portion of the development site with Bilambil Road to the north.




**LEGEND**

Site Outline

N

SOURCE:
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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*Ecological Consultants*

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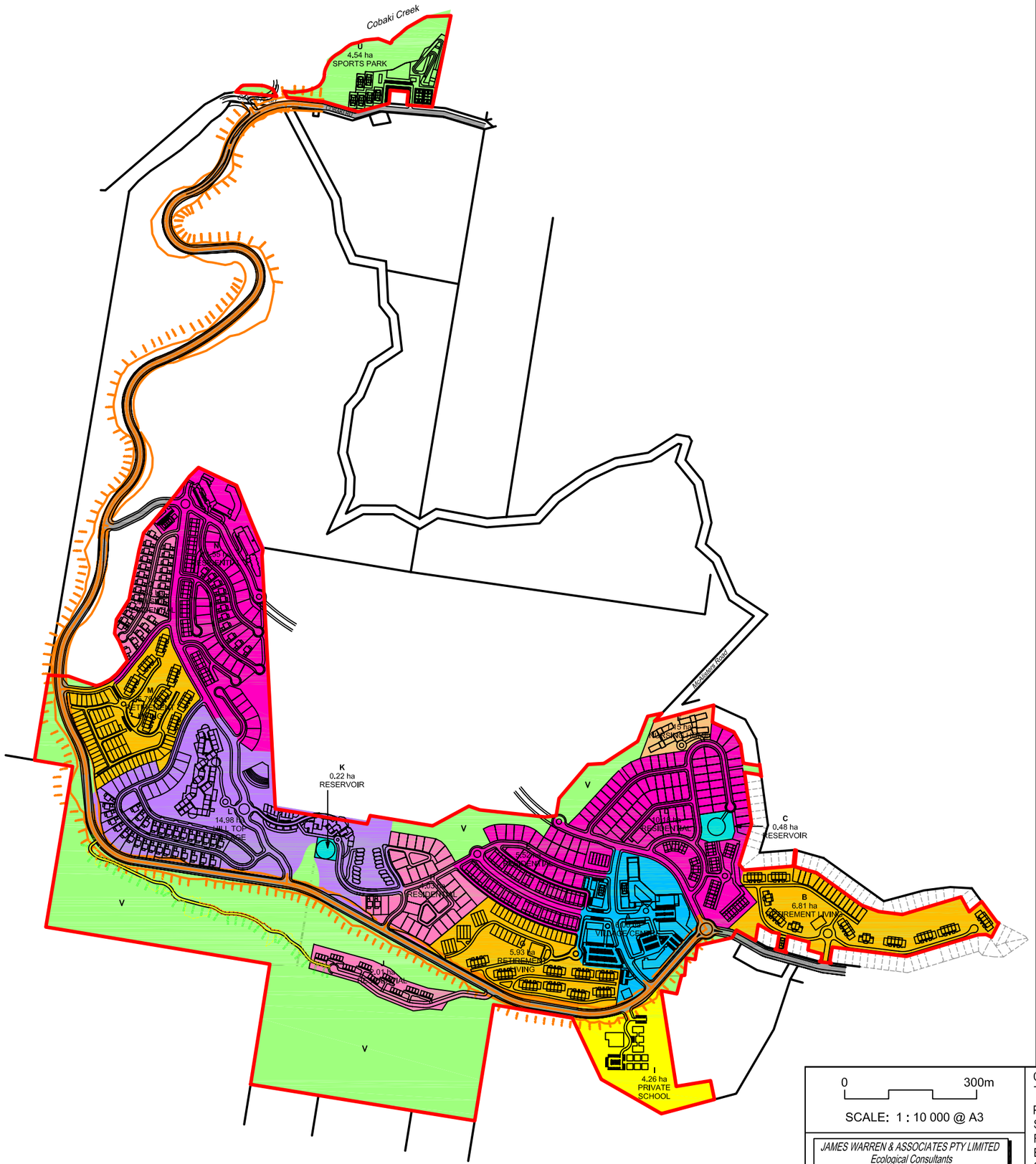
PROJECT
Site Rehabilitation & Pest Management Plan
Rise Estate
Bilambil Heights, West Tweed, NSW
Shire of Tweed

VOLUME 3
FIGURE 1

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_ORRP_Base.dwg

TITLE

AERIAL PHOTOGRAPH




## LEGEND

| | | |
|---|---|---|
| A | Village Centre |
| B | Retirement Living |
| C | Reservoir |
| D | Low Density Housing |
| E | Low Density Housing |
| F | Nursing Home |
| G | Retirement Living |
| H | Medium Density Housing |
| I | Private Schools |
| J | Residential |
| K | Reservoir |
| L | Hilltop Village |
| M | Retirement Living |
| N | Residential |
| O | Hillside Residential |
| U | Unstructured Sports Fields |
| V | Open Space & Conservation |
| | Site Outline |

SOURCE:
Layout - ML Designs (Ref: A-MP-01-16B.dwg & A-MP-01-18B.dwg)
Bushfire Track - Cardno (Ref: 510038-03-SK01 Layout Plan.dwg)

0 300m

SCALE: 1 : 10 000 @ A3

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TITLE
PROPOSED DEVELOPMENT LAYOUT

# 2. REGENERATION AND REVEGETATION STRATEGY

## 2.1 Overview of Management Intent

### *2.1.1 Rehabilitation Areas*

The proposed conservation areas for the subject site have been divided into eleven (11) rehabilitation areas (referred to henceforth as RA's) (**FIGURE 3).** Individual Regeneration and Revegetation plans are to be completed for each RA at the Operational Works stage and are to be read in conjunction with this overview plan.

The individual RA plans will generally address the following issues:

- Performance criteria
- Assessment of regeneration potential
- Weed species assessment
- Detailed Regeneration Strategy
- Detailed Revegetation Strategy
- Maintenance and Monitoring
- Timing and Responsibilities

### *2.1.2 Performance Objectives*

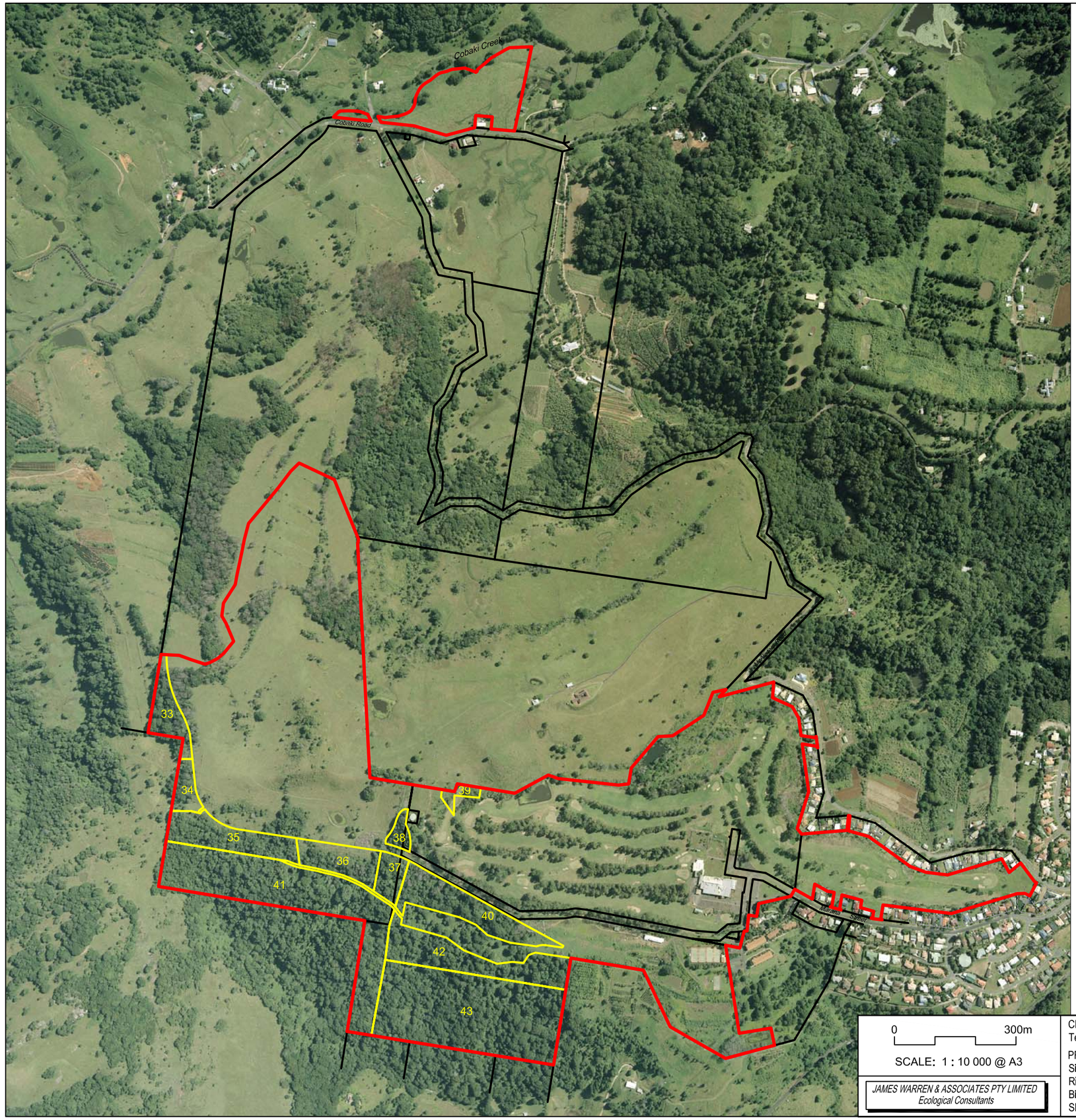
The objectives of the Site Rehabilitation and Pest Management plan are:

- To enhance vegetation to be conserved;
- To ensure no net loss of EEC's, Threatened flora species, or habitat for Threatened flora and fauna species, as a result of the development;
- To revegetate disturbed areas with endemic species, including threatened plant species;
- To obtain at least 70% native canopy cover within regeneration and revegetation areas;
- To buffer the retained vegetation (including threatened flora species) from edge effects and other disturbance related impacts;
- To improve the value of the subject site as habitat for fauna groups; and
- To manage weeds using plantings of endemic species and best practice control methods.

## 2.2 Methodology

The following methods were undertaken in the development of this plan:

- Desktop review and assessment of the existing records (e.g. threatened species, NPWS atlas of NSW wildlife database) and other documents, including the Tweed LEP etc.




**LEGEND**

| | |
|---|---|
| # | Rehabilitation Areas |
| | Site Outline |

N

SOURCE:
Rehab Areas - James Warren & Associates & Michel Group Services (Ref: 8715-37.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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TITLE

# REHABILITATION AREAS

- Site inspections were completed on 1/2/07 and again between 7/2/07 and 9/2/07. The purpose of these inspections was to determine the location of threatened flora species and to record base line data.

- The subject site was divided into RA's based on vegetation type and detailed analysis of the aerial photo.

- The base line data recorded was obtained using a minimum of two (2) 20 x 20 metre survey quadrates within each RA.

- Each RA was traversed by one qualified bush regenerator and two environmental scientists to determine the restoration potential. Areas considered to be of good to moderate potential were recorded using a hand held G.P.S and mapped on a plan showing restoration potential.

- Threatened flora species were located and surveyed using a hand held G.P.S and mapped on the survey plan.

Each of the individual RA plans will provide the following information:

- List of dominant native and exotic weed species present and an approximate frequency of occurrence;

- An evaluation of restoration potential;

- The location of Threatened flora species & other significant flora;

- A detailed plan for regeneration and revegetation to be completed:

- Species to be used in revegetation plantings;

- Ongoing maintenance & monitoring to be completed;

- Measurable performance criteria;

- Time frame and costs to complete the project.

## 2.3 Supporting Documents

JWA have completed various vegetation assessments at the subject site and have also reviewed literature relevant to revegetation and regeneration activities. Supporting documents are provided in Annexures to this plan (**ANNEXURES 2 – 10**) and provide information utilised in preparation of revegetation and revegetation plans for each RA on the subject site. A brief description of each supporting document is provided below.

### *2.3.1 Existing Vegetation Communities*

#### 2.3.1.1. Background

While much of the site has been cleared and has been historically used for pastoral and agricultural purposes, there are large areas of regrowth vegetation on the site and a substantial area of remnant subtropical rainforest.

A broad scale vegetation survey was completed by two (2) scientists on the 22nd, 23rd and 24th of November 2005, and by one (1) scientist on the 29th of November 2005 over a total period of approximately sixty (60) hours.

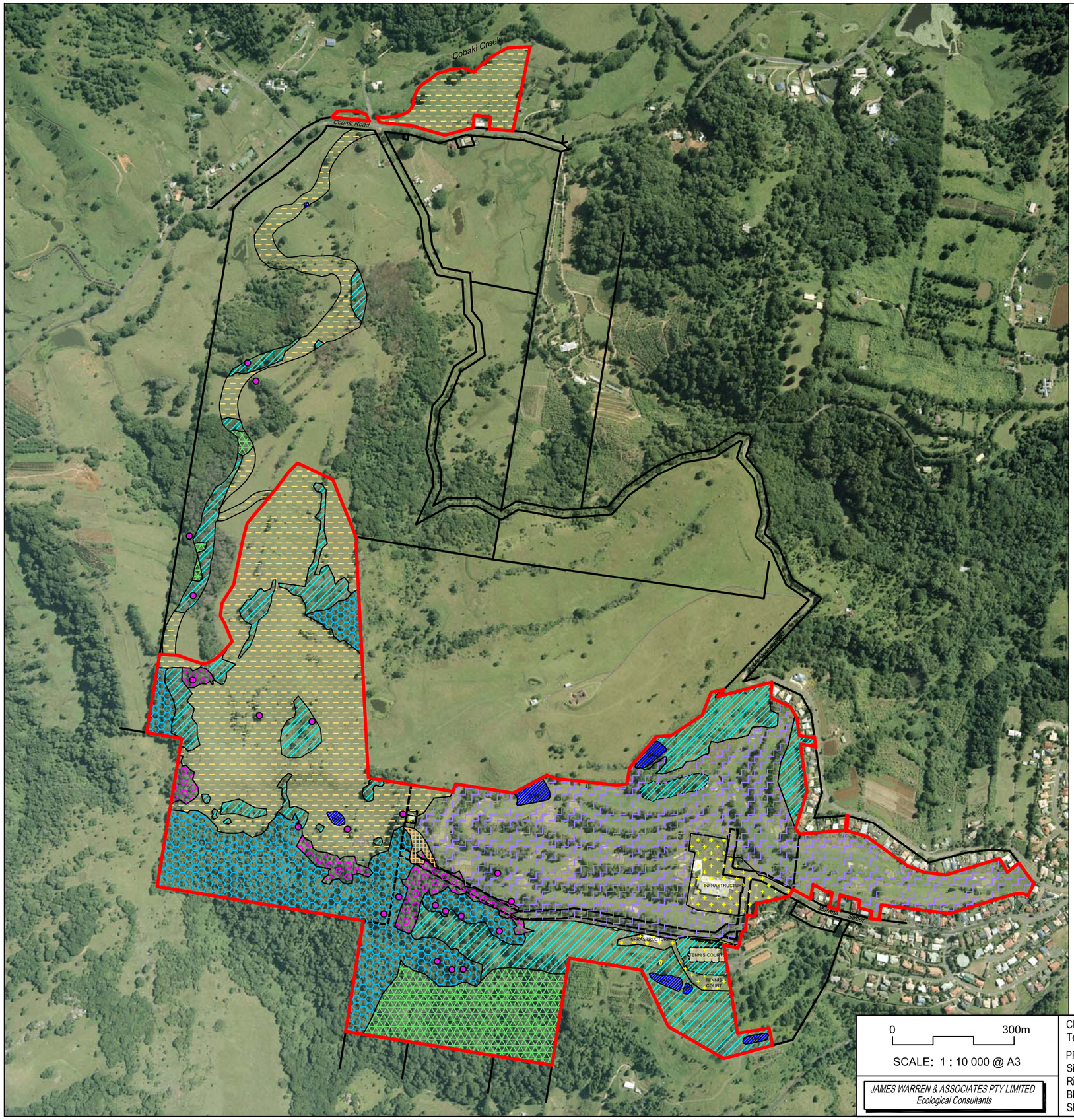
A further thirty-eight (38) hours assessment was undertaken by two (2) scientists on February 27th and 28th 2006 to investigate 7A zoned land in the south of the site, and on and offsite land occurring immediately adjacent to this area. This assessment was to determine the diversity and numbers of Threatened flora within this vegetation community, as it represents the best quality vegetation on the site.

Vegetation communities were assessed in order to ascertain their ecological value and levels of disturbance (such as the presence of Camphor laurel), and the presence of Threatened flora.

#### 2.3.1.2. Discussion

Six (6) vegetation communities were identified on the Subject site. These communities are described in **VOLUME 2** and are shown in **FIGURE 4**. One (1) Endangered Ecological Community (EEC) was recorded within the site. EECs are considered to be of a high conservation value.

Three-hundred and ninety-one (391) flora species were recorded at the Subject site including seventeen (17) threatened species. Threatened flora species recorded by JWA are shown in **TABLE 2**, along with their classification under the *Threatened Species Conservation Act* (*TSC Act 1995*) and the Commonwealth *Environment Protection and Biodiversity Act* (*EPBC Act 1999*).




## LEGEND

- Community 1 - Tall closed forest (*Cinnamomum camphora* +/- mixed species)
- Community 2 - Tall closed forest (Mixed species)
- Community 3 - Tall closed forest (*Lophostemon confertus*)
- Community 4 - Regenerating closed forest (Mixed species)
- Community 5 - Landscape plantings (Disused golf courses)
- Community 6 - Disturbed land
- Community 7 - Grassland with scattered trees
- Dams
- Existing Infrastructure
- Location of Figs (*Ficus* sp.)
- Site Outline

N

SOURCE:
Vegetation - James Warren & Associates GPS Survey Feb/March 2006, April 2009
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

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# EXISTING SITE VEGETATION

**TABLE 2**
**THREATENED FLORA RECORDED ON THE SITE**

| Common name | Botanical name | TSC Act (1995) | EPBC Act (1999) |
|---|---|---|---|
| Axe breaker # | *Geijera paniculata* | E | - |
| Ball nut # | *Floydia praealta* | V | V |
| Basket fern # | *Drynaria ruigidula* | E | - |
| Bopple nut # | *Hicksbeachia pinnatifolia* | V | V |
| Coolamon | *Syzygium moorei* | V | - |
| Fine-leaved tuckeroo | *Lepiderema pulchella* | V | - |
| Marblewood | *Acacia bakeri* | V | - |
| Rough-shelled bush nut | *Macadamia tetraphylla* | V | V |
| Rusty rose walnut | *Endiandra hayesii* | V | V |
| Small-leaved tamarind | *Diploglottis campbellii* | E | - |
| Southern ochrosia | *Ochrosia moorei* | E | E |
| Spiny gardenia | *Randia moorei* | E | - |
| Stinking laurel | *Cryptocarya foetida* | V | V |
| Sweet myrtle | *Gossia fragrantissima* | E | E |
| White laceflower | *Archidendron hendersonii* | V | - |
| Yellow satinheart | *Bosistoa transversa* | V | V |
| Yiel yiel | *Grevillea hilliana* | E | - |

V = Vulnerable, E = Endangered
# = Not previously recorded on site

Seven (7) ROTAP species were also identified on the site:

- Ardisia (*Ardisia bakeri*);
- Black walnut (*Endiandra globosa*);
- Blunt wisteria (*Millettia australis*);
- Long-leaved tuckeroo (*Cupaniopsis newmanii*);
- Smooth scrub turpentine (*Rhodamnia maideniana*);
- Stream lily (*Helmholtzia glaberrima*); and
- Veiny laceflower (*Archidendron muellerianum*).

### *2.3.2 Threatened species profiles*

#### 2.3.2.1. Introduction

The NSW *Threatened Species Conservation Act 1995* identifies and protects native plants and animals in danger of becoming extinct. In NSW flora and fauna species listed under Schedule 1 & 2 of the *Threatened Species Conservation Act 1995* are considered to be Threatened species.

The purpose of the TSCA is to:

- conserve biological diversity and promote ecologically sustainable development
- prevent the extinction and promote the recovery of threatened species, populations and ecological communities
- protect the critical habitat of those species, populations and ecological communities that are endangered

- eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities
- ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and
- encourage the conservation of threatened species, populations and ecological communities through co-operative management.

The Act divides the listed threatened species in to endangered or vulnerable.

Schedule 1 of the TSCA lists threatened species, populations and ecological communities and species that are endangered or presumed extinct. Schedule 2 lists vulnerable species.

- The TSCA defines 'endangered' as a species, population or ecological community that is likely to become extinct or is in immediate danger of extinction.
- A 'vulnerable' species is likely to become endangered unless the circumstances and factors threatening its survival or evolutionary development cease to operate.

#### 2.3.2.2. Rationale

Seventeen (17) Threatened flora species have been recorded from the subject site (**TABLE 2**).

For each of the threatened species listed under the TSCA, National Parks and Wildlife have developed a species profile, designed to educate the public on the importance of conserving the listed threatened species.

#### 2.3.2.3. Summary

**ANNEXURE 2** contains detailed Threatened species profiles for all Threatened flora species recorded from the subject site including a botanical description, a discussion of the distribution, habitat and ecology of each species, identification of threats to the species and a discussion of recovery actions (NWPS 2002).

### *2.3.3 Ecological Restoration Principles*

#### 2.3.3.1. Introduction

Ecological restoration aims to restore pre-existing indigenous ecosystems and ecological processes on disturbed sites, while maintaining and developing the natural ecosystem ability to self perpetuate

#### 2.3.3.2. Rationale

These ecological restoration principles are the underlying principles behind the overall direction of this regeneration & revegetation plan. The ecological restoration principles aim to restore the vegetation communities to the highest

practical extent using natural and assisted revegetation to develop a system that is sustainable in the long term.

#### 2.3.3.3. Summary

A review of Ecological Restoration Principles has been completed and is included as **ANNEXURE 3.** This assessment forms the basis of restoration principles and approaches considered in the preparation of each revegetation and restoration plan.

### *2.3.4 Revegetation and Regeneration Approach*

#### 2.3.4.1. Introduction

The revegetation and regeneration approach involves a variety of different methods that have been suggested on a RA specific basis. The overall methods to be implemented in the rehabilitation of the subject site are outlined in **ANNEXURE 4**.

#### 2.3.4.2. Rationale

To determine which areas of vegetation should be the focus of regeneration and revegetation activities, vegetation within each RA will be mapped and divided into six (6) different categories based on restoration potential. This will ensure that regeneration and revegetation resources will be utilised in the most efficient way by focusing on those areas that contain particular management issues (i.e. weed infestations, lack of canopy cover, poor species diversity) and matching the appropriate restoration methods for those issues.

The areas that are considered to have a restoration potential of:

- Grade 1 - Very Good condition;
- Grade 2 - Good condition; and
- Grade 3 - Moderate condition;

will be managed using only assisted regeneration in the form of exclusion fencing, weed control/eradication, and continued maintenance and monitoring.

The areas that are considered to have a restoration potential of:

- Grade 4 - Poor condition;
- Grade 5 - Very poor condition; and
- Grade 6 – Nil native vegetation;

will be managed using assisted regeneration as described above, as well as revegetation involving plantings of endemic species.

Revegetation works on the subject site will also include the propagation and replanting of some of Threatened species that occur naturally on the site. **ANNEXURE 5** lists some of the Threatened species that occur on site, comments on

the ease of propagation for each species and the fruiting times for each Threatened species.

2.3.4.3. Summary

Details of assessment of restoration potential for each RA are provided in **ANNEXURE 4.** Also discussed are Weed species assessments, and site regeneration and revegetation strategies (including weed management, propagation techniques, planting program etc.).

### *2.3.5 Weed Control Methods*

2.3.5.1. Introduction

Exotic weed invasion is a minor management issue affecting the subject site. Weeds can suppress the natural process of succession that enables forest to expand and repair damage caused by natural or human disturbance.

2.3.5.2. Rational

Much of the subtropical rainforest on the subject site is infested by exotic weeds. The control of weeds is an essential component of an effective program to ensure the long term survival of sub-tropical rainforest remnants and plantings. The subject site has undergone historical disturbance, which has left large areas of the site heavily affected by weed regrowth. Major weed removal and eradication programmes must be completed for successful regeneration to occur.

2.3.5.3. Summary

A detailed weed removal plan is contained in the plans for each RA. The weed control methods to be implemented during primary and follow up weeding are discussed in detail in **ANNEXURE 6.** The weed control methods to be used include:

- Cut stump and paint (also called Cut scrap & paint) (CS&P);
- Drill inject;
- Selective spot spraying & other spraying methods.

### *2.3.6 Staging and costs of regeneration and revegetation works*

2.3.6.1. Introduction

For each RA, the costing and staging of the rehabilitation works will vary depending on the size and condition of the RA. A plan has been developed that outlines the methods to be used in calculating costing for each RA. A staging plan has been developed containing a time line indicating the approximate year work is to commence and be completed.

2.3.6.2. Rational

The works to be undertaken are designed to be implemented over a ten (10) year period. This plan has been developed to outline the cost and staging of works to be completed each year. The costing for the regeneration of each RA has been calculated based on:

- The total area (m2) of the RA;
- The total area to be fenced;

- The extent of weed invasion and work required to remove;
- The number of plants to be used in revegetation plantings;
- The physical features of the site (slope, growth medium, distance from water).

2.3.6.3. Summary

**ANNEXURE 7** outlines methods used in costing calculations and provides approximate costing of works within each RA. A time line of works to be completed for the ten (10) year duration of the project is also included in **ANNEXURE 7**.

### *2.3.7 Tendering of Works*

**ANNEXURE 8** provides an outline for the tendering of all regeneration, revegetation and maintenance works on the subject site.

### *2.3.8 Maintenance*

2.3.8.1. Introduction

Regular maintenance or follow up work is an essential part of the regeneration process.

2.3.8.2. Rational

Maintenance to be completed is essential for the long term condition and health of the regeneration and revegetation zones. Regular maintenance is required to ensure that primary weeding has the best chance of success.

2.3.8.3. Summary

Regular maintenance will be a vital component of the continuing regeneration of each RA. **ANNEXURE 9** outlines maintenance requirements and timing of maintenance works.

### *2.3.9 Monitoring*

2.3.9.1. Introduction

A monitoring program is to put in place by the client and will be continued for the duration of the ten (10) year plan.

2.3.9.2. Rational

Monitoring is necessary to demonstrate that work carried out has achieved the desired outcomes, and to evaluate the relative success of the different methods used.

2.3.9.3. Summary

**ANNEXURE 10** outlines the monitoring requirements for each RA, including timing, basic indicators to be monitored, and reporting of results.

# 3. PEST ANIMAL CONTROL STRATEGY

## 3.1 Introduction

Pest animals are those that have potentially negative environmental impacts. These species are generally non-native and pose a threat to biodiversity values within open space areas.

Several species of animals deemed as pests have been identified, or are likely to occur on the Subject site. These include:

- Wild dogs
- Feral cats
- Rabbits/hares
- Cane toads
- Foxes
- Feral Pigs

These species have the potential to impact negatively on Threatened fauna species identified on the Subject site, either directly through predation or through competition for resources.

Pest animals such as those listed above generally enjoy widespread distribution across a variety of habitat types, and typically have high mobility and reproductive rates. As such, eradication is not considered feasible, and management strategies should be focused on minimising populations in areas of high ecological value, where impacts are potentially greatest.

Management of pests in parks and reserves within the Tweed area is covered by the NSW National Parks and Wildlife Service *Northern Rivers Region Pest Management Strategy 2008 – 2011.* The measures outlined in this report aim to complement the goals and methodology of the NPWS strategy.

## 3.2 Management Intent

The following sections provide background information on pest animal species potentially occurring on the Subject site and outline the management strategy for each. It must be noted that it is the applicant's proposal that the Rise project is to be structured under a Community Title Scheme (CTS). The CTS will create the requirement for a Body Corporate (BC) to manage the entire estate. The BC will create By Laws for which all residents and their guests will have to abide by. The BC will have a management structure and the lawful authority to police the BY Laws. The By Laws will include regulations for the control of animals by the residents in the estate. Should a resident or guest not comply with the By Laws the BC will have the power to have the animal removed from the estate. These By Laws will include a requirement that residents or guests animals must not be allowed to enter the environmental protection areas of the estate. Further, it is proposed that all environmental protection land on the subject site will become Common Property to the Body Corporate ensuring long term maintenance of these areas and perpetual control of feral animals.

### *3.2.1 Wild dogs*

#### 3.2.1.1. Introduction

Wild dogs are a declared pest under the *Rural Lands Protection Act 1998.* Difficulties in the control of wild dogs have arisen from their ability to hybridise with native Dingos, which are not always readily distinguishable from their feral counterparts (*Northern Rivers Region P MS 2008-2011 PP 24)*

Wild dogs may also negatively impact on Dingo (and potentially other native animal) populations by acting as vectors for disease, and are also likely to prey on indigenous fauna. They pose a significant economical problem by killing livestock (such as sheep and cattle) belonging to farmers, and may also pose a threat to public safety in some circumstances (*Northern Rivers Region P MS 2008-2011 PP 24 Section 11.1.1)*.

#### 3.2.1.2. Strategy

- Domestic dogs to be prohibited within conservation areas by the Body Corporate.
- Leg – hold traps/baiting regimes within conservation areas are to be undertaken at the end of May during breeding, and again in early September when natural prey is scarce (if required) and in cooperation with the NPWS and Tweed Shire Council control programs (*N. Hing 2009, pers. comm., 30 Mar*.).
- Baiting is to occur every two months initially and then subsequently subject to monitoring using the sand padding technique (*N. Hing 2009, pers. comm., 30 Mar*.).
- Residents/business owners encouraged to contact the Body Corporate if Wild dogs are sited.

### *3.2.2 Feral cats*

#### 3.2.2.1. Introduction

Feral cats are predominantly nocturnal and occupy a home range of up to 280 hectares. They are most common in open environments (e.g. grasslands) in close proximity to urban or rural areas (*Northern Rivers Region PMS 2008-2011 PP 28 Section 11.1.2*).

Feral cats prey on a large range of native animals. They appear to have the largest impacts on small mammals, however will also catch birds, amphibians, reptiles, fish and insects. They may also act as vectors for disease that affect native wildlife and humans (e.g. toxoplasmosis, sarcosporidiosis) (*Northern Rivers Region PMS 2008-2011 PP 28 Section 11.1.2*)

#### 3.2.2.2. Strategy

- Domestic cats to be prohibited within conservation areas by the Body Coporate.

- Cage trapping regimes within conservation areas are to be undertaken throughout the year subject to monitoring, and in cooperation with the NPWS and Tweed Shire Council control programs (*N. Hing 2009, pers. comm., 30 Mar*.).
- Baiting must involve the varying of food sources and if possible the initial use of free feed before cage traps are deployed to increase trapping effectiveness (*N. Hing 2009, pers. comm., 30 Mar*.).
- Residents/business owners encouraged to contact the Body Corporate if feral cats or roaming domestic cats are sited.

### *3.2.3 Rabbits/Hares*

#### 3.2.3.1. Introduction

Rabbits and hares are common across a variety of habitats. They are a major prey item for other pest animals such as cats, dogs and foxes and can contribute to higher populations of these species. Through selective grazing upon palatable vegetation species they can be responsible for the alteration of flora assemblages and habitats. Burrowing activities may cause soil disturbance, resulting in erosion and in some cases preventing the regeneration of native flora (*Northern Rivers Region PMS 2008-2011 PP 38 Section 11.1.8*).

#### 3.2.3.2. Strategy

- Trapping/baiting regimes within conservation areas are to be undertaken throughout the year subject to monitoring (*N. Hing 2009, pers. comm., 30 Mar*.).
- Monitoring strategies are to involve visual and spotlighting techniques (*N. Hing 2009, pers. comm., 30 Mar*.).

### *3.2.4 Cane toads*

#### 3.2.4.1. Introduction

The Cane toad, a native of central/south America, is well established in the Tweed area and is toxic at all stages of its life cycle, posing a threat to native fauna that may attempt to prey on it. They are superior competitors, being able to survive in a range of temperatures and environments. They prey on native frogs, insects and small reptiles and compete with native frogs for food and breeding sites (*Northern Rivers Region PMS 2008-2011 PP 32 Section 11.1.4*)

#### 3.2.4.2. Strategy

- Any water features to be constructed as part of the development should incorporate dense fringing vegetation (e.g. Lomandras, sedges) in order to restrict access to the water by Cane toads.
- Periodic collection (either manual or through use of specialised traps) and humane disposal of Cane toads should be conducted by the Body Corporate, during times of high rainfall or when large numbers of toads are evident.

- Water will not be permitted to pool in disturbed areas during construction in order to eliminate further breeding opportunities for toads.
- Any mulch for use in rehabilitation or landscaping projects should be inspected, by the Body Corporate, for presence of Cane toads.

### *3.2.5 Foxes*

#### 3.2.5.1. Introduction

The Red fox can have significant impacts on a variety of native wildlife through predation, most notably small and medium mammals, ground ground-nesting birds and freshwater turtles (*Northern Rivers Region PMS 2008-2011 PP 30 Section 11.1.3)*. Foxes, along with wild dogs, can also carry and transmit diseases to livestock.

#### 3.2.5.2. Strategy

- Foxes to be prohibited within conservation areas.
- Leg – hold traps/baiting regimes within conservation areas are to be undertaken at the end of May during breeding, and again in early September when natural prey is scarce (if required) and in cooperation with the NPWS and Tweed Shire Council control programs (*N. Hing 2009, pers. comm., 30 Mar*.).
- Baiting is to occur every two months initially, and then subsequently subject to monitoring using the sand padding technique (*N. Hing 2009, pers. comm., 30 Mar*.).
- Residents/business owners encouraged to contact council if Foxes are sited.

### *3.2.6 Feral Pigs*

#### 3.2.6.1. Introduction

Feral Pigs are predominantly nocturnal and can cause widespread damage to native seedling recruitment. They are most common in open environments (e.g. grasslands) in close proximity to urban or rural areas (*Northern Rivers Region PMS 2008-2011 PP 28 Section 11.1.2*).

Feral cats prey on a large range of native animals. They appear to have the largest impacts on small mammals, however will also catch birds, amphibians, reptiles, fish and insects. They may also act as vectors for disease that affect native wildlife and humans (e.g. toxoplasmosis, sarcosporidiosis) (*Northern Rivers Region PMS 2008-2011 PP 28 Section 11.1.2*)

#### 3.2.6.2. Strategy

- Feral Pigs to be prohibited within conservation areas.
- Cage trapping regimes within conservation areas are to be undertaken throughout the year subject to monitoring, and in cooperation with the NPWS and Tweed Shire Council control programs (*N. Hing 2009, pers. comm., 30 Mar*.).

- Baiting must involve the varying of food sources and if possible the initial use of free feed before cage traps are deployed to increase trapping rates (*N. Hing 2009, pers. comm., 30 Mar*.).

# 4. SUMMARY

This plan (and supporting documents) contains an overview of rehabilitation and pest management strategies that will be implemented on the subject site. This plan should be read in conjunction with detailed plans prepared for each RA. Each RA plan will contain:

- A detailed set of directions on the most appropriate methods of:
  - Weed control;
  - Regeneration techniques;
  - Pest control;
  - Monitoring procedures.
- Measurable performance criteria.

By achieving the objectives outlined in these plans via the suggested strategies, all conservation areas are to be successfully regenerated or revegetated.

Areas with an intact canopy considered to be of good to medium condition will be subject to regeneration works. Revegetation will occur in areas considered to be in poor to very poor condition. This will provide improved and extended habitat for a variety of flora and fauna within the locality.

The Performance Objectives within each plan will contain measures designed to allow the applicant to demonstrate that revegetation objectives are being achieved, to allow Council to sign off on the success of the program. The proposal that the project is structured under a Community Title Scheme and that all environmental protection land will become Common Property to the Body Corporate ensures that these areas can be policed and maintained in perpetuity.

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# ANNEXURE 1 – FUTURE REHABILITATION WORKS

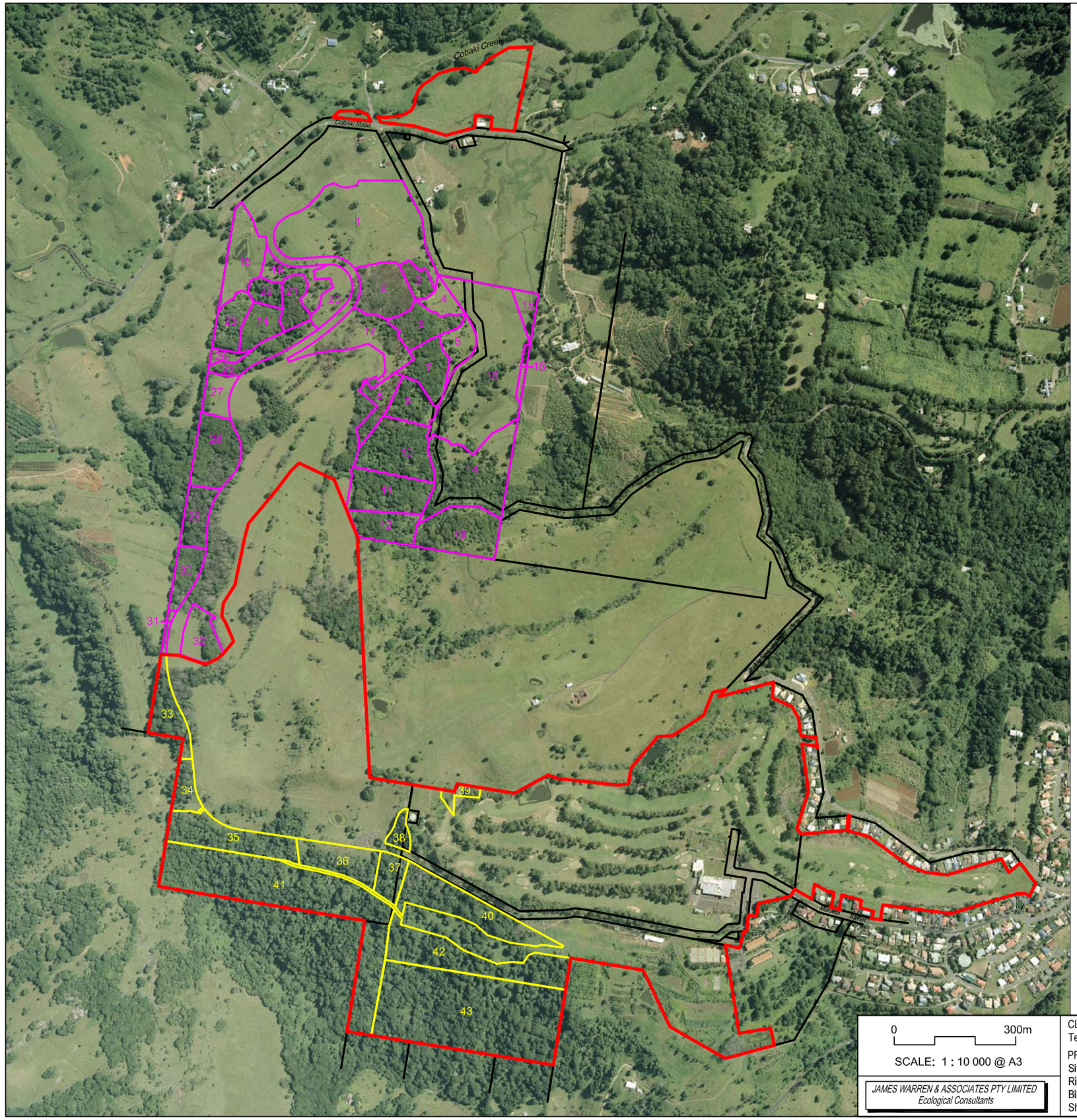
## INTRODUCTION

Further rehabilitation works, in addition to those outlined in this report are planned for the RISE estate. Whilst this proposed future rehabilitation work does not form part of the MP08-0234 application it is deemed important that the consent authorities are made aware that the applicant has a strategy for the full scope of proposed environmental protection and restoration works envisaged for the entire Rise site.

## REHABILITATION INTENT

The area to be rehabilitated under Stage 2 has been divided into thirty-two (32) Rehabilitation Areas (RA's). These RA's comprise a total of 45.2 hectares of rehabilitation works. Details of these rehabilitation plans are outlined in **FIGURE 1.**

Rehabilitation of these RA's will be directed by a Stage 2 Overview Rehabilitation Plan, to be submitted along with the development application for this phase of the development.




**LEGEND**

- # Rehabilitation Areas - Stage 1
- # Rehabilitation Areas - Stage 2
- Site Outline

N

SOURCE:
Rehab Areas - James Warren & Associates & Michel Group Services (Ref: 8715-37.dwg)
Aerial Photograph - Michel Group Services taken 2006 (Ref: bilambil_heights_2006-reduced.jpeg)

0 300m

SCALE: 1 : 10 000 @ A3

*JAMES WARREN & ASSOCIATES PTY LIMITED*
*Ecological Consultants*

CLIENT
Terranora Group Management Pty Ltd

PROJECT
Site Rehabilitation & Pest Management Plan
Rise Estate
Bilambil Heights, West Tweed, NSW
Shire of Tweed

VOLUME 3
ANNEXURE 1 FIGURE 1

PREPARED: BW
DATE: 27 April 2009
FILE: N01051_ORRP_Base.dwg

TITLE

REHABILITATION AREAS

# ANNEXURE 2 - THREATENED SPECIES PROFILES

## AXE BREAKER

**Scientific name:** *Geijera paniculata*
**Conservation status in NSW:** Endangered

**Description**
Axebreaker grows from 3 to 6 m in height, and has a dense head of deep green to yellow-green foliage. As its name suggests, its timber is very hard. The branchlets are bright green turning grey to brown, and finely wrinkled. The smooth, glossy, dark-green leaves are oval, measuring 5 – 10 cm long. They are bluntly pointed at the tips, and are strongly fragrant when crushed. The leaf-stalk is about 11 mm long and deeply channelled on the upper surface. Flowers are small and white in small clusters. The dry brown fruit contain glossy black seeds.

**Distribution**
Moderately common in restricted habitat in Queensland between the Brisbane River and the central Queensland coast, but very rare in north-east NSW, where it is known from the Tweed, Lismore and Wardell areas.

**Habitat and ecology**

- Axebreaker is found in dry subtropical rainforest and vine scrub, often along rivers.

**Threats**

- Clearing and fragmentation of habitat for development and agriculture.
- Risk of local extinction due to low numbers.
- Infestation of habitat by introduced weeds, particularly vine weeds and Lantana.
- Grazing and trampling by domestic stock.
- Fire.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Avoid fire in and around the edges of rainforest patches.
- Exclude cattle from remnant rainforest by fencing.
- Control weeds in rainforest areas.
- Protect areas of suitable habitat from clearing or development.
- Expand and connect remaining remnants of habitat.

# BALL NUT

**Scientific name:** *Floydia praealta*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
This tree grows to 35 m tall, with rough, brown, slightly wrinkled bark. It is closely related to the Macadamia. The leaves are 10 – 25 cm long and 1 – 3 cm wide, tapering at the bases but rounded at the tips, and with slightly wavy margins. They are shiny green and leathery, without hairs. The flower buds are creamy brown, and when open are cream and spidery with a musky odour. The woody, globular, brown fruit is 5 cm in diameter and contains one or two inedible seeds.

**Distribution**
Small scattered populations distributed from Gympie in Queensland to the Clarence River in north-east NSW.

**Habitat and ecology**

- Riverine and subtropical rainforest, usually on soils derived from basalt.

**Threats**

- Clearing and fragmentation of habitat for coastal development, agriculture, roadworks and powerlines.
- Risk of local extinctions because populations are small and sparsely distributed.
- Infestation of habitat by weeds.
- Grazing and trampling of seedlings and saplings by domestic stock, particularly around remnant paddock trees.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Fence rainforest remnants and isolated paddock trees to exclude grazing stock.
- Identify populations along roadsides and powerline easements and protect them during works.
- Remove weeds where they threaten adult plants or regeneration.
- Protect areas of habitat from clearing or development.
- Expand and connect remaining remnants of habitat.
- Report new records to the DEC.

# BOPPLE NUT

**Scientific name:** *Hicksbeachia pinnatifolia*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
Red Bopple Nut is a small tree to 10 m tall, often with several unbranched stems rising from the rootstock. The leaves are leathery and compound, 40 – 100 cm long and deeply lobed, or with many leaflets and a winged central spine. The lobes or leaflets have prickly toothed margins and the veins are prominent on both sides. A loose spike of many spidery-flowers, 15 – 35 cm long, arises directly from the trunk from ground level upwards. The flowers are purplish brown with a strong, sickly scent. Bright red fleshy fruits, 2 – 4 cm long, follow the flowers.

**Distribution**

Coastal areas of north-east NSW from the Nambucca Valley north to south-east Queensland.

**Habitat and ecology**

- Subtropical rainforest, moist eucalypt forest and Brush Box forest.

**Threats**

- Clearing of rainforest habitat for development or agriculture.
- Invasion of habitat by introduced weeds, particularly Lantana and exotic vines.
- Fire.
- Collection of seed for horticulture.

**What needs to be done to recover this species?**

- Protect rainforest, moist eucalypt forest and Bush Box forest from fire.
- Control introduced weeds
- Protect remnant subtropical rainforest habitat.
- Initiate and support projects to rehabilitate remnant habitat and regenerate rainforest.

# COOLAMON

**Scientific name:** *Syzygium moorei*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
Durobby, also known as Coolamon, is a tree growing up to 40 m tall, with dense dark foliage. The bark is red-brown, light grey or pinkish grey with soft papery scales. Its paired leaves are thick, oval-shaped or slightly elongated, 8 - 20 cm long, and usually rounded at the tips. Flowers are showy, pink to red, fluffy, and clustered directly on older leafless branches and the trunk of the tree. The white fleshy fruits are edible but tasteless. They have a diameter of up to 6 cm and enclose a single seed.

**Distribution**
Found in the Richmond, Tweed and Brunswick River valleys in north-east NSW and limited occurrence in south-east Queensland.

**Habitat and ecology**

- Coolamon is found in subtropical and riverine rainforest at low altitude. Often occurs as isolated remnant paddock trees.

**Threats**

- Clearing and fragmentation of habitat for development, agriculture and road-works.
- Weed infestation and general degradation of rainforest habitats.
- Grazing and trampling of seedlings and saplings by domestic stock, particularly around remnant paddock trees.
- Illegal collection for horticulture.

**Recovery strategies**

Priority actions are the specific, practical things that must be done to recover a threatened species, population or ecological community. The Department of Environment and Conservation has identified **10 priority actions** to help recover Coolamon in New South Wales.

**What needs to be done to recover this species?**

- Buy plants only from licensed nurseries.
- Fence rainforest remnants and isolated paddock trees to exclude grazing stock.
- Control weeds in known and potential habitat.
- Protect areas of suitable habitat from clearing or development.
- Expand and connect remnants of suitable habitat and encourage regeneration of habitat around isolated paddock trees.

# FINE-LEAVED TUCKEROO

**Scientific name:** *Lepiderema pulchella*
**Conservation status in NSW:** Vulnerable

**Description**
Fine-leaved Tuckeroo is a small rainforest tree growing to 15 m tall. It has hairless, light-green glossy leaves, 7 – 15 cm long, which are made up of 4 – 14 narrow leaflets with wavy or toothed margins. The flowers are 2 – 3 mm long and yellowy-orange. The 8 – 10 mm long fruit is orange. This opens into three lobes revealing shiny dark-brown seeds with a yellow fleshy covering at the base. The fruit is ripe in December.

**Distribution**
The NSW north coast north of Brunswick Heads, and in Queensland. Most records in NSW are from the Tweed Valley, and the majority of known populations are on private land.

## Habitat and ecology

- Lowland subtropical rainforest in NSW.
- Found on infertile metasediments and on fertile basalts in the Tweed Valley.

**Threats**

- Invasion of habitat by introduced weeds.
- Clearing and fragmentation of habitat for development.
- Collection of seed for horticulture.

**What needs to be done to recover this species?**

- Buy plants only from licensed nurseries
- Remove weeds in known and potential habitat.
- Protect areas of lowland subtropical rainforest from clearing or fragmentation.
- Seek a permit from the DEC before collecting seed from wild plants.

# MARBLEWOOD

**Scientific name:** *Acacia bakeri*
**Conservation status in NSW:** Vulnerable

**Description**
Marblewood is a tree of 5 – 30 m with wrinkled bark and a rounded canopy that is much darker and denser than that of most wattles. Its curved leaves are broad and dark green, with three to four prominent longitudinal veins, and thickened veins around the edges. The flower heads are small, round, and pale or golden yellow, and are followed by large bunches of flat, brown seed-pods containing several black seeds.

**Distribution**
Restricted to coastal south-east Queensland and north-east NSW, where it occurs north from Mullumbimby. Most plants are on private property.

**Habitat and ecology**

- In or near lowland subtropical rainforest, adjacent eucalypt forest or regrowth of both. Usually occurs in the understorey but may occur as a large canopy tree.

**Threats**

- Loss of habitat through land development and agriculture.
- Invasion by weeds, particularly Lantana.
- Fire, which kills adult trees and encourages weed growth.
- Visitor impacts in high use areas.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Control fire in areas of known or potential habitat.
- Ensure walking tracks in tourist areas do not disturb known habitat and stay on established tracks in rainforest areas.
- Assist in control and removal of weeds from rainforest areas.
- Protect areas of rainforest and adjoining eucalypt forest from clearing and development.

# ROUGH-SHELLED BUSH NUT

**Scientific name:** *Macadamia tetraphylla*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
The Rough-shelled Bush Nut is a small to medium-sized, usually densely bushy, tree growing up to 18m tall. The leaves are 7 – 25 cm long and oblong or slightly lance-shaped. The leaf-margins are toothed and prickly. Creamy pink to purplish flowers hang in long strings among the leaves. The fruit is woody brown and globular, 2 – 3 cm in diameter. The edible seeds are enclosed in a hard, wrinkled, brown shell inside a round green husk. Most commercial macadamias are hybrids of this species and the Queensland species *Macadamia integrifolia*.

**Distribution**
Confined chiefly to the Richmond and Tweed Rivers in north-east NSW, extending just across the border into Queensland.

**Habitat and ecology**

- Found in subtropical rainforest, usually near the coast.

**Threats**

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks.
- Risk of local extinction due to low numbers.
- Grazing and trampling by domestic stock.
- Fire.
- Invasion of habitat by weeds.
- Loss of local genetic strains through hybridisation with commercial varieties.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Protect rainforest from fire.
- Exclude grazing stock from known areas of habitat by fencing.
- Control weeds in rainforest areas.
- Protect areas of rainforest habitat from clearing or development.
- Expand and connect remaining remnant patches of habitat.
- Plant commercial hybrid macadamias away from wild populations.

## RUSTY ROSE WALNUT

**Scientific name:** *Endiandra hayesii*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
Often a small crooked tree, but can grow to 35 m tall. It has grey to grey-brown bark, which is smooth or slightly scaly. The dull, hairy leaves are egg-shaped and measure 6 – 12 cm long and 3 – 6 cm wide. The leaves have a closely veined appearance. Flowers are small and white to pale green, and are held in small clusters. The fleshy fruits are egg-shaped, 2.5 – 3 cm long, and purplish-black when ripe.

**Distribution**
A restricted distribution from Burleigh Heads in Queensland to the Richmond River in north-east NSW. It is locally abundant in some parts of its range in NSW.

**Habitat and ecology**

- Sheltered moist gullies in lowland subtropical and warm temperate rainforest on alluvium or basaltic soils.

**Threats**

- Clearing and fragmentation of habitat for development, agriculture and road-works.
- Timber harvesting activities.
- Infestation of habitat by weeds.
- Fire.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Stay on established tracks in rainforests.
- Avoid fire in and near rainforest patches.
- Remove weeds where they threaten adult plants or regeneration.
- Protect areas of rainforest habitat from clearing or development.
- Exclude areas of rainforest habitat from timber harvesting
- Expand and connect remaining areas of habitat.

## SMALL-LEAVED TAMARIND

**Scientific name:** *Diploglottis campbellii*
**Conservation status in NSW:** Endangered
**National conservation status:** Endangered

**Description**
A large straight tree up to 30 m tall. It has greyish-brown bark with vertical cracks. New leaves are at first softly-hairy, but soon become more or less hairless. The leaves are 10 - 35 cm long and are divided into four to eight leaflets. Small clusters of greenish-white flowers are borne amongst the leaves. The fruits are creamy-brown and in crowded clusters about 10 cm long. The capsules, usually three-lobed, enclose one seed per lobe. Each seed is surrounded by yellow or deep pinkish-red flesh.

**Distribution**
Recorded from the coastal lowlands between Richmond River on the Far North Coast of NSW and Mudgeeraba Creek on the Gold Coast hinterland, Queensland.

**Habitat and ecology**

- Confined to the warm subtropical rainforests of the NSW-Queensland border lowlands and adjacent low ranges.
- The forest types in which the species occurs vary from lowland subtropical rainforest to drier subtropical rainforest with a Brush Box open overstorey.
- Occurs on basalt-derived soils and also on poorer soils such as those derived from quartz monzonite.
- Flowering times vary across its range depending on latitude and to some extent annual seasonal variations.
- Ripe fruits are generally present from January to early April, with peak fruiting during the last week of February and early March.
- Seed dispersal mechanisms are unclear.

**Threats**

- Clearing and fragmentation of habitat is believed to be the primary reason for decline.
- Risk of local extinction because populations are small.
- Loss of, or physical damage to plants from roadways and road maintenance.
- Physical damage to plants and compaction of soils from grazing and trampling by stock.
- Infestation of habitat by weeds.

**What needs to be done to recover this species?**

- Buy plants only from licensed nurseries.
- Encourage regeneration of the species and its habitat by fencing isolated paddock trees.
- Remove weeds where they threaten adult plants or regeneration.
- Protect areas of suitable habitat from clearing and road-works.

- Undertake habitat restoration works in known and potential habitat.

## SOUTHERN OCHROSIA

**Scientific name:** *Ochrosia moorei*
**Conservation status in NSW:** Endangered
**National conservation status:** Endangered

**Description**
Southern Ochrosia is a small tree, sometimes crooked with several stems, growing up to 11 m tall. The bark is very dark brown, finely wrinkled and rough. The leaves are 8 – 20 cm long, arranged in twos or threes, varying in shape but tapering to a long point at the tips and gradually narrowing at the base. They are green and shiny, paler beneath, and thin in texture. When picked, the leaf-stalk exudes a milky sap. Small white flowers are held in small clusters at the ends of branchlets. The shiny scarlet fruit is oval-shaped and 4 – 8 cm long.

**Distribution**
Southern Ochrosia is found in north-east NSW north from the Richmond River, and in south-east Queensland. It is very sparsely distributed within this range.

**Habitat and ecology**

- Southern Ochrosia is found in riverine and lowland subtropical rainforest.

**Threats**

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks.
- Risk of local extinction because populations are small.
- Invasion of habitat by introduced weeds.
- Collection of seed for horticulture.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Buy plants only from licensed nurseries.
- Assist with the removal of introduced weeds.
- Protect areas of rainforest habitat from clearing or development.
- Expand and connect remaining remnant patches of habitat.
- Seek a permit from the DEC before collecting seed from wild plants.

## SPINY GARDENIA

**Scientific name:** *Randia moorei*
**Conservation status in NSW:** Endangered
**National conservation status:** Endangered

**Description**
Spiny Gardenia is a tall shrub or small tree to about 8 m tall, often with coppice shoots and root suckers at the base. The paired leaves are mostly oval-shaped, and can be 2 - 6 cm long and 1 - 3 cm wide. The underside of the leaf is paler than the upper surface, and often has small pits in the angles of the veins. Flowers are small and white, with a strong sweet smell, and develop into round yellow to orange berries 6 - 9 mm long which eventually turn black. There are many seeds set in the pulp of each fruit.

**Distribution**
From Lismore in north-east NSW north to the Logan River in south-east Queensland. Sparsely distributed, with most records in the Tweed and Brunswick areas.

**Habitat and ecology**

- Subtropical, riverine, littoral and dry rainforest. In NSW, Hoop Pine and Brush Box are common canopy species.

**Threats**

- Clearing and fragmentation of habitat for development, agriculture and roadworks.
- Invasion of habitat by introduced weeds.
- Trampling by visitors.
- Fire.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Keep to established tracks to avoid trampling on small plants.
- Protect rainforest areas from fire.
- Remove weeds where they threaten adult plants or regeneration.
- Protect areas of suitable habitat from clearing or development.
- Expand and connect remaining remnants of habitat.

## STINKING LAUREL

**Scientific name:** *Cryptocarya foetida*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
Stinking laurel is a small to medium-sized tree growing to 20 m tall, with a dark green crown, and brown, slightly fissured bark. The leaves are oval-shaped with a bluntly pointed tip, 5 – 12 cm long and 2 – 6 cm wide, dark green on the upper surface and paler below. The main leaf vein is prominent, yellow and characteristically crooked. The species is named from the offensive odour of the small creamy flowers, which are borne in small clusters. The purplish to black, fleshy, globular fruits are about 1 cm in diameter, and enclose a single round seed.

**Distribution**
Coastal south-east Queensland and north-east NSW south to Iluka.

**Habitat and ecology**

- Found in littoral rainforest, usually on sandy soils, but mature trees are also known on basalt soils.
- The seeds are readily dispersed by fruit-eating birds, and seedlings and saplings have been recorded from other habitats where they are unlikely to develop to maturity.
- Though seedlings can be fairly numerous, few mature trees are known.

**Threats**

- Risk of local extinction because populations are small.
- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks.
- Infestation of habitat by weeds.
- Trampling by visitors when accessing beach areas through littoral rainforest.
- Fire.

**What needs to be done to recover this species?**

- Keep to tracks and avoid trampling on small plants.
- Support local Landcare groups and bush regeneration teams.
- Avoid fire in and around the edges of patches of littoral rainforest.
- Remove weeds where they threaten adult plants or regeneration.
- Protect areas of littoral rainforest from clearing or development.
- Expand and connect remaining areas of habitat.

## SWEET MYRTLE

**Scientific name:** *Gossia fragrantissima*
**Conservation status in NSW:** Endangered
**National conservation status:** Endangered

**Description**
Sweet myrtle (formerly *Austromyrtus fragrantissima*) is a multi-stemmed shrub or small tree, about 4 –10 m tall. The bark is rough, brown and fissured to flaky. Its small, glossy leaves usually have a tiny point at the apex and are paired on the stem. New leaves are shiny and reddish. The flowers are small, white and fragrant and are followed by small, round, yellow to orange berries.

**Distribution**
Occurs in south-east Queensland and in north-east NSW south to the Richmond River. Mostly found on basalt-derived soils.

**Habitat and ecology**

- Dry subtropical and riverine rainforest.
- As it can coppice from roots left in the ground when rainforest is cleared, it is found at several sites as isolated plants in paddocks or regrowth.

**Threats**

- Habitat degradation through weed invasion and disturbance.
- Loss of habitat through clearing and fragmentation.
- Risk of local extinction because populations are small.
- Grazing by domestic stock.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Fence rainforest remnants to protect them from cattle.
- Provide water for cattle away from creeks and rivers.
- Control weeds in dry subtropical and riverine rainforest.
- Protect areas of rainforest habitat.
- Expand and connect remaining remnants of habitat.

# WHITE LACEFLOWER

**Scientific name:** *Archidendron hendersonii*
**Conservation status in NSW:** Vulnerable

**Description**
White laceflower is a tree to 18 m tall, with light-brown bark. Its leaves are divided twice, into glossy hairless leaflets separated unequally by the midvein. Up to ten fragrant, fluffy creamy-white flowers are bunched in heads. Woody orange pods develop, splitting and curling to reveal glossy black seeds displayed against the red or yellow interior of the pod.

**Distribution**
From north Queensland south to the Richmond River in north-east NSW. It is found on a variety of soils including coastal sands and those derived from basalt and metasediments.

**Habitat and ecology**

- Riverine and lowland subtropical rainforest and littoral rainforest.

**Threats**

- Loss of habitat through clearing and fragmentation.
- Habitat degradation through weed invasion and disturbance.
- Illegal collection of seeds for horticulture.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Buy White Laceflower plants only from licensed nurseries.
- Control weeds in rainforest areas.
- Protect areas of rainforest habitat from clearing and development.
- Expand and connect remaining remnant patches of habitat.

# YELLOW SATINHEART

**Scientific name:** *Bosistoa transversa*
**Conservation status in NSW:** Vulnerable
**National conservation status:** Vulnerable

**Description**
A crooked tree up to 22 m tall with a dense dark-green crown. The broad, leathery leaves are heart-shaped at the base and paired on the stem. The lower leaf surface is paler green than the upper surface, and has prominent veins. The small white flowers are borne in loose clusters at or near the tips of the branches. The fruits are hard, ribbed and egg-shaped with a flattened end, and contain a single kidney-shaped seed. Heart-leaved Bonewood is now considered to possibly belong to the same species as Yellow Satinheart (*Bosistoa transversa*).

**Distribution**
From Maryborough in Queensland south to the Nightcap Range north of Lismore in north-east NSW.

**Habitat and ecology**

- Lowland subtropical rainforest up to 300 m in altitude.

**Threats**

- Loss of habitat through clearing and fragmentation.
- Habitat degradation through weed invasion and disturbance.
- Grazing by domestic stock.
- Fire.
- Timber harvesting.

**What needs to be done to recover this species?**

- Support local Landcare groups and bush regeneration teams.
- Protect rainforest habitat from fire.
- Fence creeksides and rainforest areas to exclude stock.
- Control weeds.
- Protect remaining habitat from clearing and development.
- Expand and connect remaining areas of rainforest habitat.
- Undertake taxonomic study to clarify status of this species and *Bosistoa selwynii*.

# YIEL YIEL

**Scientific name:** *Grevillea hilliana*
**Conservation status in NSW:** Endangered

**Description**
White Yiel Yiel is a rainforest tree 8 – 30 m tall. The young leaves are deeply lobed and mostly 25 – 40 cm long and 15 – 30 cm wide, while the adult leaves are often without lobes. The lower surface of both the young and the adult leaves is silvery and silky. The white to pale-green flower heads are cylindrical, 8 – 22 cm long and appear mainly during May to July.

**Distribution**
North from Brunswick Heads on the north coast of NSW and in Queensland. The only populations currently known in NSW are near Brunswick Heads and on the slopes of Mt Chincogan in Byron Shire and, in Tweed Shire in remnant patches of habitat, particularly around Terranora.

**Habitat and ecology**

- White Yiel Yiel grows in subtropical rainforest, often on basalt-derived soils.

**Threats**

- Risk of extinction because populations are small and distribution is restricted.
- Loss of habitat through clearing for development.
- Habitat degradation through invasion by introduced weeds.
- Seed collection for horticulture.

**What needs to be done to recover this species?**

- Buy plants only from licensed nurseries.
- Prevent weeds and garden plants from invading habitat.
- Protect remnant rainforest areas from development.
- Seek a permit from the DEC before collecting seed from wild plants.
- Report new occurrences to the DEC.

# ANNEXURE 3 - ECOLOGICAL RESTORATION PRINCIPLES

Ecological restoration aims to restore pre-existing indigenous ecosystems and ecological processes on disturbed sites, maintaining and developing the natural ecosystem to self perpetuate (Perkins 1992). Perkins (1992) put forward a *restoration continuum* spanning from assisted natural regeneration, the least interventionist, to reconstruction (of original communities on cleared sites) and fabrication (of new communities on changed sites). These activities are undertaken in different circumstances in the field, but the boundaries are blurred, allowing practitioners to consider sites on an individual basis, according to the level of disturbance and the restoration potential identified in the site. The aim of ecological restoration is to restore to the highest practicable extent, and to develop a system that is sustainable in the long term.

In disturbed areas that cannot solely rely on natural regeneration potential, revegetation can be undertaken to reconstruct the original forested communities. Cleared sites can be replanted with species grown from seed collected in nearby local native vegetation. The use of seed of local provenance (origin) is a key principle underpinning the integrity of the work, and avoids possible genetic pollution of local woodland when future pollen exchange takes place between remnant and replanted woodland.

Unfortunately the suite of species that is available is often narrow, determined by practicalities of seed collection, the ability to propagate in a nursery and limits on field establishment in the environmental conditions prevailing on cleared land. Conceptually, this is merely establishing a framework into which additional plant and animal diversity can recruit or be reintroduced once the environment is modified (Perkins 1992).

Cleared sites are seldom completely devoid of native species. It is common to observe paddocks supporting threads of the original ground cover vegetation. This is often apparent in paddocks historically sown with exotic grasses to improve pasture. While the introduced grasses are usually dominant, a surprising diversity of native grasses and groundcovers can often persist. They have remained through a history of sustained grazing and are by definition adapted to grazing. The act of excluding livestock or other management activities can threaten native diversity, as biomass from the introduced grasses smothers these plants. Alternative biomass reduction can be achieved with slashing and fire however these have different effects and their own practical limitations.

Total groundcover biomass is reduced under a developing canopy, a phenomenon also evident in re-growing forest communities. The vigour of exotic grasses is greatly diminished and some are unable to grow, leaving room for native plants that are adapted to the woodland ecosystem. Of course some native plants lose vigour in the forest canopy as well. Revegetation is thus forming an important mechanism for grassland manipulation and as a tool for creating a variety of niches in the ground layer. At the same time, revegetation is achieving the obvious objectives of increasing habitat values, restoring normal hydrology and increasing the range of species available to recover in a site after disturbance. Revegetation needs to be used in combination with other techniques, and these processes will need to be studied in detail before they can be conclusively described as positive.

The mechanism of planting is likely to be a most important strategy in revegetation of the site, not as an end in itself, but as an important tool to ameliorate changed sites and release ecosystem resilience. While prolonged monitoring needs to be maintained in revegetation areas, there are indications that environmental conditions within the site will change in interesting ways as revegetation develops.

**Reference**

Perkins, I. 1992. *Land and Vegetation Management Plan for the Horsley Park Corridor.*

# ANNEXURE 4 - REVEGETATION AND REGENERATION APPROACH

## 1. INTRODUCTION

To determine which areas of vegetation should be the focus of regeneration and revegetation activities, vegetation within each RA will be mapped and divided into six (6) different categories based on restoration potential. This will ensure that regeneration and revegetation resources and methods will be utilised in the most efficient way by focusing on those areas that contain particular management issues (i.e. weed infestations, lack of canopy cover, poor species diversity) and matching the appropriate restoration measures for those issues. Additionally, the classification of these six (6) categories will dictate the nature and staging of regeneration and revegetation over the required ten (10) year period.

The six (6) management categories are based on the McDonald (1996) vegetation restoration system[1] and are shown in **TABLE 1.**

**TABLE 1**
**VEGETATION MANAGEMENT CATEGORIES AND ACTIONS**

| **Management Categories** (Based on restoration potential) | **Management Actions** |
|---|---|
| **1 – Very good condition.** Structure and composition of vegetation community generally intact. Low evidence of degradation. Likely to recover fully with passive intervention. | Maintenance |
| **2 – Good condition.** Structure somewhat altered by low level impacts. Likely to recover fully if casual factors and their secondary impacts are removed by active intervention. Likely to degrade further if no remedial action taken. | Natural or Assisted regeneration |
| **3 – Moderate condition.** Structure altered by high level impacts. High level visual impacts may be present. Likely to recover fully if causal factors and their secondary impacts removed by active intervention, but will take longer to recover that a site of higher condition. | Assisted regeneration |
| **4 – Poor condition.** Structure and/or composition highly altered. Sufficient biota remain for natural regeneration if causal factors and their secondary impacts are removed and dynamic processes reinstated. Reintroduction of some species (including Threatened species) may be required. | Assisted regeneration/ Revegetation |

[1] Degradation classification system used in McDonald, M. Christine, 1996. Ecosystem resilience and the restoration of damaged plant communities: A discussion focusing on Australian case studies. Ph.D. Dissertation, University of Western Sydney.

| | |
|---|---|
| **5 – Very poor condition.** Structure and/or composition severely altered. Either insufficient biota remain for natural regeneration (except some ruderal species), or sever weed infestation occurs and is likely to prevent native regeneration. | Assisted regeneration/ Revegetation |
| **6 – Nil native vegetation.** | Revegetation |

# 2. WEED SPECIES ASSESSMENT

## 2.1 Introduction

Within each RA the occurrence of exotic weed species has been recorded, and an assessment of the overall condition and frequency of weed species has been evaluated.

The weed species presence and the intensity of the invasion are required to prepare the most efficient control program for each individual RA.

## 2.2 Methods

With each RA the vegetation was mapped using a minimum of two (2) 20 x 20 metre survey quadrats to determine percentage cover. Within each quadrat the percentage cover was calculated by 2 scientists and the dominate weed species and prominent native vegetation were recorded.

## 2.3 Results

The result of each RA survey effort will be recorded in individual RA plans.

# 3. SITE REGENERATION STRATEGIES

## 3.1 Introduction

The majority of vegetation on the subject site has experienced historical and current anthropogenic alterations principally due to impacts from cattle grazing and the recent Camphor laurel eradication program. This anthropogenic modification has provided opportunities for weed species to invade the natural vegetation communities. Exotic species have persisted and competed with native species for limited resources (e.g. light, nutrients and water). This acts as a limiting factor for regeneration of native species. Therefore, in order to enhance the natural values of the site, weed control and weed removal techniques are required for all identified vegetation management categories at varying levels.

The objectives of the site regeneration strategies for each RA are to:

- Remove weeds utilising “best practice” protocols;
- Maintain and monitor the site to ensure success; and
- Improve the current ecological values of areas containing habitat for identified significant species.

### 3.2 Methods

Regeneration methods implemented are to be site specific are detailed in each individual RA plans. The overall strategies are based on the principles of assisted regeneration and will include:

- Locating and marking clearly all Threatened species;
- Removing dangerous (overhanging & unstable) Camphor laurel;
- Manual hand weeding 2 metres around threatened species;
- Selective Camphor Laurel poisoning;
- Primary weeding
    - C,S & P Woody Weeds
    - Small natives (less than 20cm) are to be weeded around (50 cm), staked, and clearly marked
    - Selective spot spraying or blanket spraying if required
- Follow up weeding and other maintenance to be completed until objectives are achieved;
- Continued monitoring for the life of the project.

A regular maintenance program will be implemented for each RA after primary weeding has occurred. The maintenance to be completed is discussed in **ANNEXURE 8.** The monitoring program is discussed in **ANNEXURE 9.**

## 4. SITE REVEGETATION STRATEGIES

### 4.1 Background

Within disturbed areas, competition between native propagules and exotic weeds often favours pioneering exotic species. Thus, in order to enhance the ecological function of areas degraded by exotic species, revegetation works will provide a framework by which indigenous species may reclaim lost habitat via the processes of natural recruitment and succession. Therefore, the aim of revegetation works within each RA is to restore the historical ecological values of the site through the use of weed removal techniques and the provision of indigenous canopy species.

Revegetation will be required within areas graded 4, 5 or 6 as described in Table 1**.** Revegetation will commence approximately three (3) months after the primary weeding has been completed. This will allow for any native seedlings to germinate naturally. Each RA will be regularly monitored. Two (2) months after primary weeding has occurred the site will be assessed for natural recruitment of native species. Any areas that are considered to have low native recruitment potential are suitable for revegetation.

Bi-annual assessment will be made of each RA. In any areas within which the occurrence of native species is considered low, revegetation will be required.

Revegetation will continue on an as needed basis dependent upon the proponents budgetary constraints.

### 4.2 Propagation

Seed collected for propagation will come from the site and immediate surrounds as well as local provenance (i.e. from local stock within 20 km of the subject site). The following details will be collected from each source plant:

- Location (GPS position);
- Date of collection;
- Name of collector;
- Soil type;
- Health of plant; and
- Collection method.

Whenever possible, seed will be removed directly from plants by shaking or cutting branches over a tarpaulin. Secateurs will be sterilised between each use. Seed will be placed in small envelopes with the collection details clearly marked. If the seed is extremely small it will be stored in glass or plastic vials to avoid undue loss.

It is expected that during the seed collection program, a site will be visited on several occasions to ensure optimum seed ripeness. The seed collection program will be prepared in consultation with Council and NSW National Parks and Wildlife Service (NPWS) prior to commencement. The program will be prepared by the Nursery/Revegetation team in consultation with the Horticulturist.

The amount of seed collected will not exceed 5% per plant. Seed will not be collected from isolated populations or rare plants.

The seed will be cleaned, its viability checked and prepared for storage. Seed that has lost viability will not be used in the revegetation works due to the dangers of genetic aberration.

If seed collection proves difficult or impossible, other forms of propagation, such as cuttings, may be attempted.

## 4.3 Planting Program

All exclusionary fencing will be in place before planting occurs.

Existing native trees and shrubs, which have regenerated since clearance, would be retained. These areas would be enhanced with plantings as deemed appropriate by the Horticulturist.

Planting will occur at the optimum time of the year when there is high soil moisture (between January and May), unless irrigation is available and accessible.

If required, the Horticulturist may make minor alterations to this revegetation strategy depending on the site requirements. The following strategy will be employed:

- Seedling sites will be spot sprayed with Glyphosate one (1) week prior to commencement;

- All seedlings will be soaked in water overnight prior to planting;
- All seedlings will be provided with a wetting agent such as rain-saver[2] crystals;
- Weeds will be controlled, in the short term, through the application of suitable mulch around individual plantings and with spot applications of an appropriate herbicide.
- All seedlings will be protected by a tree guard (commercial tubing or equivalent); and
- Watering will be undertaken after the seedlings have been planted on an 'as need basis'.

The plants growing medium would be soaked prior to planting and the plant cores should be buried to approx 1-2cm deep.

The seedlings shall be planted on the same day as their transport from the nursery. No seedlings will be left unprotected on the site whilst awaiting planting. Planted seedlings will be marked with a piece of biodegradable tape and staked.

Only nitrogenous fertilisers will be used to avoid the introduction of Phosphorous, Potassium and other micronutrients.

Planting in areas exposed to full sun or westerly sun will be avoided in the peak summer months, where possible.

- Seedlings are to be planted at an approximate density of 2 metre centres were appropriate.
- Planting density may be inconsistent throughout the planting zone, due to occurrence of native seedlings and the condition of the planting medium (in large areas of the subject site basalt boulders occur as ground cover, and revegetation may not be practical)

[2] Rain-saver is a polymer water crystal that has been specifically developed for plants. The polymer absorbs and holds water and nutrients at a specific tension which makes it available to plant roots but does not release to the soil. Rain-saver has proven very successful in more difficult environments (eg Roadside plantings on the Pacific Motorway between Brisbane and the Gold Coast and in frontal dunes at Pottsville (R. Keene *pers comm.* 2000).

# ANNEXURE 5 – PROPAGATION OF THREATENED FLORA SPECIES

Due to the accidental harm to a number of Threatened flora species, it is recommended that the revegetation include the extensive replanting of some of Threatened species that occur naturally on the site. Listed below in **TABLE 1** are some of the Threatened species that occur on site and comments on the ease of propagation for each species. **TABLE 2** lists the fruiting times for each Threatened species.

Comments have been obtained from experienced local sources including:

- Mark Dunphy ( Manager of the Firewheel Rainforest Nursery)
- Brett O'Donovan ( Manager of Terania Creek Nursery)

**TABLE 1**
**LIST OF THREATENED SPECIES AND COMMENTS ON PROPAGATION**

| Common Name | Botanical name | Dunphy Comments | O'Donovan Comments |
|---|---|---|---|
| Axe breaker | *Geijera paniculata* | unknown | unknown |
| Ball nut | *Floydia praealta* | Easy | Very slow to take |
| Bopple nut | *Hicksbeachia pinnatifolia* | Easy | Pretty easy |
| Coolamon | *Syzygium moorei* | Easy | Easy |
| Fine-leaved tuckeroo | *Lepiderema pulchella* | Easy | OK, usually only 20% of seed germinates |
| Marblewood | *Acacia bakeri* | Easy, but fruits seasonal | Easy |
| Red lilly pilly | *Syzygium hodgkinsoniae* | Easy | Relative easy |
| Rough-shelled bush nut | *Macadamia tetraphylla* | Easy | Easy |
| Rusty rose walnut | *Endiandra hayesii* | Easy, fruits hard to get | OK – hard to get seed |
| Small–leaved tamarind | *Diploglottis campbellii* | Easy | Easy |
| Southern ochrosia | *Ochrosia moorei* | unknown | Very hard |
| Spiny gardenia | *Randia moorei* | Easy, fruit may be hard to collect | Poor germination (10-20%). Birds love fruit |
| Stinking laurel | *Cryptocarya foetida* | Easy | Hard to get seed (compete with birds) – good crop every few years |
| Sweet myrtle | *Gossia fragrantissima* | East to germinate, but hard to get seed, small yield, eaten by birds | Hard to get seed (compete with birds) – very slow growing |
| White laceflower | *Archidendron transversa* | Easy | Easy - fresh seed lasts a few weeks |
| Yellow satinheart | *Bosistoa transversa* | unknown | Very hard to propagate and get seed |
| White yiel yiel | *Grevillea hilliana* | Easy, wind borne seed can be hard to collect | Hard to get Seed good amount of seed |

**TABLE 2**
**FRUITING TIMES OF THREASTENED FLORA ON THE SITE**

| Common Name | Botanical name | Fruiting period (Floyd) |
|---|---|---|
| Axe breaker | *Geijera paniculata* | Fruit ripe Jan – Feb |
| Ball nut | *Floydia praealta* | Fruit ripe Jan – Feb |
| Bopple nut | *Hicksbeachia pinnatifolia* | Fruit ripe Sept – Jan |
| Coolamon | *Syzygium moorei* | Fruit ripe March – May |
| Fine-leaved tuckeroo | *Lepiderema pulchella* | Fruit ripe December |
| Marblewood | *Acacia bakeri* | Fruit ripe Jan – April |
| Red lilly pilly | *Syzygium hodgkinsoniae* | Fruit ripe Aug – Nov |
| Rough-shelled bush nut | *Macadamia tetraphylla* | Fruit ripe May – August |
| Rusty rose walnut | *Endiandra hayesii* | Fruit ripe March – Aug |
| Small – leaved tamarind | *Diploglottis campbellii* | Fruit ripe Feb – March, esp. last week of Feb/first week march (DEC) |
| Southern ochrosia | *Ochrosia moorei* | Fruit ripe Dec – Feb |
| Spiny gardenia | *Randia moorei* | Fruit ripe Dec – Aug |
| Stinking laurel | *Cryptocarya foetida* | Fruit ripe June – Aug |
| Sweet myrtle | *Gossia fragrantissima* | Fruit ripe Jan – Feb |
| White laceflower | *Archidendron transversa* | Fruit ripe June – Jan |
| Yellow satinheart | *Bosistoa transversa* | Fruit ripe May – July |
| White yiel yiel | *Grevillea hilliana* | Fruit ripe Feb - July |

**Section 91 Licence**

Under the NSW Threatened Species Conservation Act (TSC Act 1995), a licence is required for activities which may result in any of the following actions involving threatened plants:

- Picking a threatened species, population or ecological community
- Damaging Critical Habitat
- Damaging the habitat of a threatened species, population or ecological community.

The Director – General cannot compel anyone to apply for a section 91 licence. This is the choice of the potential applicants who must weigh up the risk of not being protected by a licence for actions which may result in the harming or picking of a threatened species, population or ecological community, and/or the damaging of habitat of a threatened species, population or ecological community.

# ANNEXURE 6 - WEED CONTROL METHODS

The following are control techniques that are to be utilised during site regeneration works:

- **Cut Stump Method** - This method involves cutting plant stems as close to ground level as possible and immediately painting the cut stump with herbicide. This treatment can also be applied as a basal bark application to the first 15-20 cm (entire circumference) of an uncut stem if the adult bark has not yet developed. Chemical use with this application is dependant on the proximity of the weed to naturally ponding water or waterways and whether or not the chemical is registered for aquatic use.

- **Stem Injection** - Herbicides may be applied directly to the plant via stem injection. This involves applying an herbicide to the plant directly by drilling a hole into the stem and inserting the chemical. Axe cuts for stem injection can also be used. Cuts can be made at regular intervals around the stem and should leave a "pocket" in to which the chemical must be immediately injected. Axe cuts should penetrate the cambium layer, but not the hardwood.

- **Spray Method** - There are two (2) types of spraying methods that will be employed where appropriate:

    - Selective blanket spraying: The area must initially be checked for the presence of any native species. Any weeds within 2 m of the drip zone of existing native species will be removed by hand. Alternatively, native species will be covered with impermeable material (e.g. a tarpaulin) for protection during spraying;
    - Spot spraying: The spray nozzle will be kept close to ground to avoid any overspray. Individual weeds will be spot-sprayed at the site. This method of spraying will be employed as native species are interspersed throughout the exotic grasses; and
    - Herbicides specific to each target species, where appropriate, will be identified prior to the implementation of any works. Herbicides will be applied in accordance with the manufacturer's specifications and when environmental conditions are most preferred (e.g. wind and rainfall).

- **Cutting and Chipping** - Manual weeding may involve cutting and chipping, pulling, digging or slashing and is preferred, depending on the growth stage and situation as detailed:

    - Where native plants are growing within a weed infestation and the use of selective herbicide is not possible;
    - Where inadequate foliage is present to allow for successful uptake of herbicide e.g. Mile-a-minute runners typically exhibit this trait; and

- When hand weeding, the stem must be grasped firmly at the base of the plant and pulled. A trowel, mattock or sharp knife may be needed to loosen the soil. Care must be taken not to leave behind stems or other plant pieces that may re-shoot. Hand weeding should also be undertaken at times when weeds are not seeding to reduce dispersal and spread. Hand pulling is not recommended for some weed species as they readily sucker if their roots are disturbed e.g. *Lantana camara.* This method will be employed when removing exotic grass species within retained vegetation.

- **Ring Barking -** This method involves removing the lower bark from the stem using a sharp implement to expose the phloem and xylem tissue to the outer environment thereby destroying it.

- **Basal Bark Method** - This method involves applying an herbicide to the lower 35-45 cm bark around the entire stem using a hand-pump backpack sprayer fitted with a shut-off at the wand tip and an adjustable cone nozzle or a small, ATV (All Terrain Vehicle)-mounted sprayer with a shut-off at the wand tip and an adjustable cone nozzle.

# ANNEXURE 7 - STAGING AND COSTING OF REGENERATION AND REVEGETATION WORKS

## 1. BACKGROUND

The following section outlines methods to calculate the approximate costing for work to be completed during the ten (10) year duration of the project for each RA.

## 2. METHODS FOR COSTING

### 2.1 Propagation

The total costing for the propagation of each RA has been calculated based on the approximate number of seedlings to be raised and transported to the site for planting. The number and costs of the propagation of the seedling to be planted will differ between each RA depending on the following variables:

- The size of the RA
- The size of the area to be revegetated
- The species to be planted

### 2.2 Fencing

The total costing for the fencing of each RA has been calculated based on the approximate length of the RA boundary and the total area of the revegetation zones that are to be fenced. The Fencing Cost have been calculated from Prices quoted from A.R.C Fences Ballina December 06 and are shown in **TABLE 1**.

**TABLE 1**
**FENCING COST**

| **MATERIALS** | **Cost** |
|---|---|
| Single Star pickets = | $ 4.60 each |
| 200m of galvanised wire | $ 32 |
| **MATERIALS AND LABOUR FOR 200 METRES OF FENCING** | **Cost 200m** |
| 50 star pickets for 200 metres of fencing | $4.60 x 50 m = $230 |
| Four (4) lines of wire 200 metre long | $32 x 4 =$128 |
| Labour cost approximately $3.50 per meter | 3.50 x 200 = $700 |
| Total cost for 200m | = $1058 |
| Total for 100m | = $525 |

## 2.3 Erosion control

Erosion control may be required in some areas to be regenerated and/or revegetated. Erosion control will be in the form of continuous rows of straw bales (or equivalent) pegged down across the contours.

The costing for each RA is to be calculated on the size of the area to be protected from erosion and the number of straw bails and pegs to be used within each RA.

## 2.4 Weed eradication, Revegetation & Maintenance

The primary weeding, revegetation & maintenance is to be completed by employees contracted by the client (Mantle Group).

### *2.4.1 Weed eradication*

Costing for Weed Control Program is based on the average rate for a qualified bush regenerator; an approximate hourly rate is $35 an hour.

Weed Control is to consist of:

- Primary weeding
  - Two qualified bush regenerators for approximately two (2) to three (3) weeks;
  - CS&P, Hand weeding & selective spot spraying were appropriate;

- Follow up maintenance to be completed six (6) weeks after primary weeding has occurred
  - One qualified Bush regenerators for one day.

- Regular follow up maintenance will be required every three months, for the next three years
  - One qualified Bush regenerators for each maintenance day.

The work to be completed and approximate time to complete will vary between each RA. An approximated costing for RA 3 is listed in **TABLE 2**

**TABLE 2**
**COSTS FOR WEED ERADICATION - LABOUR AND MATERIALS**

| Work to be completed | No. Work hours |
|---|---|
| Primary Weeding | 20 days x 8 hours = 160 h |
| Follow up maintenance | One(1) day = 8 h |
| Regular follow up maintenance | 12 visits X 8 hours = 96 h |
| Total hours of works to be completed<br>Cost per Hour for Qualified Bush Regenerator | = 264 man hours<br>X 35$ per hour |
| **Total Cost for Labour** | $ 9240 Over Three (3) years |

Average Cost for knockdown Chemicals per hectare per application including labour:

Approximately $120 per hectare for each application completed. (Schirmer & Field, 2000)

### *2.4.2 Planting Costs*

Costing for Planting and Materials, based on comments from Mark Dunphy (Firewheel Rainforest Services) December 06 are shown in **TABLE 3.**

**TABLE 3**
**APPROXIMATE COSTING FOR PLANTING MATERIALS & LABOUR**

| **Materials & Labour** | **Cost Per Tree** |
|---|---|
| Price per plant tube stock<br>Pioneers<br>Secondary | **$1.60** |
| Mature phase in<br>Round tube<br><br>Large square | **$ 2**<br><br>**$ 3** |
| Cost each tube tree including<br>• Site preparation<br>• Planting<br>• Fertiliser<br>• Plastic sleeve & 3 stakes | **$ 5** |
| Cost each Square tree including<br>• Site preparation<br>• Planting<br>• Fertiliser<br>• Plastic sleave 3 stakes | **$ 7** |
| Maintenance is site specific and conditional<br>Average per year per tree | **$ 1** |
| Average Price per plant with three (3) years maintenance | **$ 9.50** |

To calculate the total number of trees to be planted within a revegetation area the total area to be revegetated in metres, is divided by the planting density (distance between each plant) in metres squared.

Total number of trees required = Total area to be planted ($Am^2$)*divided by the Spacing between plants ($S^2$)* squared (density).

$Am^2$ * divided by $S^2$* = Number of plants to be planted.

Number of plants to be planted is to be multiplied by nine dollars fifty ($ 9.50 average price of plant with maintenance). The result will be an approximate total cost of plantings including three years maintenance.

* Total Area of revegetation to be completed = $Am^2$
S = Spacing of plantings
Planting's are to be planted at a two (2) metre spacing S = 2m

## 2.5 Monitoring costs

The monitoring is to be completed by a qualified ecologist and will consist of site visits every three months for the three years after planting has occurred.

Monitoring visits for each site visit should take approximately one (1) hour plus travel time. The Number of visits required and the approximate cost for an ecologist visit is listed **TABLE 4.**

**TABLE 4**
**LIST THE NUMBER OF VISITS REQUIRED AND THE HOURLY RATE FOR AN ECOLOGIST**

| | |
|---|---|
| Approximate cost per visit for a Qualified ecologist | $330 per visit |
| Approximate Number of visit in 10 years | 25 |
| **Approximate Total Cost of Monitoring one (1) RA over 10 years** | $8250 |

The approximate total cost for the monitoring includes (2) hours travel time and a one (1) hour site inspection for each RA to be monitored.

# 3. TIMING OF WORKS

The proposed schedule for the rehabilitation works to be completed within each RA is listed below in **TABLE 5.**

**TABLE 5**
**SCHEDULE OF WORKS TO BE COMPLETED**

| | Year1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| RA33 | **PW** | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 34 | **PW** | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 35 | **PW** | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 36 | **PW** | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 37 | **PW** | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 38 | **PW** | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 39 | - | **PW** | mm | mm | mm | mm | mm | mm | mm | mm |
| 40 | - | **PW** | mm | mm | mm | mm | mm | mm | mm | mm |
| 41 | - | **PW** | mm | mm | mm | mm | mm | mm | mm | mm |
| 42 | - | **PW** | mm | mm | mm | mm | mm | mm | mm | mm |
| 43 | - | **PW** | mm | mm | mm | mm | mm | mm | mm | mm |
| RA 1 | - | **PW** | mm | mm | mm | mm | mm | mm | mm | mm |
| 2 | - | **PW** | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 3 | - | - | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 4 | - | - | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 5 | - | - | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 6 | - | - | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 7 | - | - | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 8 | - | - | **PW** | mm | mm | mm | mm | mm | mm | mm |
| 9 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 10 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 11 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 12 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 13 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 14 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 15 | - | - | - | **PW** | mm | mm | mm | mm | mm | mm |
| 16 | - | - | | - | **PW** | mm | mm | mm | mm | mm |
| 17 | - | - | - | - | **PW** | mm | mm | mm | mm | mm |
| 18 | - | - | -- | - | **PW** | mm | mm | mm | mm | mm |
| 19 | - | - | - | -- | **PW** | mm | mm | mm | mm | mm |
| 20 | - | - | - | - | **PW** | mm | mm | mm | mm | mm |
| 21 | - | - | - | - | **PW** | mm | mm | mm | mm | mm |
| 22 | - | - | - | - | **PW** | mm | mm | mm | mm | mm |
| 23 | - | - | - | - | - | mm | mm | mm | mm | mm |
| 24 | - | - | - | - | - | **PW** | mm | mm | mm | mm |
| 25 | - | - | - | - | - | **PW** | mm | mm | mm | mm |
| 26 | - | - | - | - | - | **PW** | mm | mm | mm | mm |
| 27 | - | - | - | - | - | **PW** | mm | mm | mm | mm |
| 28 | - | - | - | - | - | **PW** | mm | mm | mm | mm |
| 29 | - | -- | - | - | - | **PW** | mm | mm | mm | mm |
| 30 | - | - | - | - | - | - | **PW** | mm | mm | mm |
| 31 | - | - | - | - | -- | - | **PW** | mm | mm | mm |
| 32 | - | - | - | -- | - | - | **PW** | mm | mm | mm |

PW = Primary Works includes:

- Primary weeding,

- Follow up weeding
- Revegetation plantings

mm = monitoring and maintenance includes:

- On going maintenance **(ANNEXURE 8)**
- Monitoring **(ANNEXURE 9)**

# ANNEXURE 8 - TENDERING OF WORKS

A suitably qualified nursery (Horticulturist) and Revegetation Team will be engaged via a tender process. If necessary an annual tender process for each stage of the revegetation strategy may be undertaken.

The Horticulturist will consult with the appointed Nursery/Revegetation Team to finalise the list of species to be planted in relevant locations. The final list will depend upon the availability of species at the time required. If the species listed for each RA are not available, provision will be made to secure and plant these species at a later stage. If certain species contained in this document are not considered suitable then a justification should be recorded by the Horticulturist and lodged with Council.

The Nursery/Revegetation Team will provide the Horticulturist with a revegetation strategy which will include a program for the collection of material (seed and cuttings) to be utilised in vegetative revegetation. The strategy will discuss the following points;

- Collection proposal;
- Species mix and density;
- The source of seeds/cuttings to be utilised;
- Size of the cuttings/seedlings to be utilised;
- Date at which revegetation is to commence; and
- Strategies for early care and monitoring of the revegetation area.

The Horticulturist will review the strategy, programs and plans. The Horticulturist should suggest amendments where required. The revegetation can commence when the strategy has been finalised and approved.

# ANNEXURE 9 - MAINTENANCE

## 1. INTRODUCTION

Maintenance or follow up works are vital for the continuing regeneration and revegetation of the RA's. Regular maintenance will be completed by the rehabilitation team. Once canopy closure has been achieved the period of time between maintenance visits will increase.

## 2. TIMING OF MAINTENANCE

After primary weeding and revegetation works, regular follow up maintenance will be required within each RA. The Revegetation Team will be required to complete:

- Regular maintenance of the regeneration & revegetation zone, once every three (3) months until canopy closure has been achieved. This is expected to take between two (2) – three (3) years.
- After canopy closure has been achieved, the removal of weed re-growth and other general maintenance tasks will only be completed every six (6) months until completion of the ten (10) year project.

## 3. MAINTENANCE REQUIREMENTS

The maintenance is to be completed by the rehabilitation team and will include:

- Control of invasive weeds and grasses;
- Ensuring adequate soil nutrient levels within revegetation zones by periodic fertilising;
- Ensuring adequate soil moisture levels within revegetation zones by using irrigation during times of prolong drought;
- Repairing exclusion fencing when required;
- Pruning and thinning to allow for optimal growth and form;
- Staking or propping–up of trees which have fallen or developed a permanent lean;
- Replacing large areas of dead trees;
- Re-mulching and re-fertilising of the revegetation plantings is recommended after the first year.

Continued maintenance after canopy closure will be required only once every six (6) months, and will include:

- Pruning and thinning to allow for optimal growth and form;
- Control of invasive weeds and grasses;
- Repairing or removing fencing when required.

# ANNEXURE 10 – MONITORING & REPORTING

## 1. INTRODUCTION

The Horticulturist and qualified ecologist will inspect the revegetation zones before revegetation commences to ensure suitable preparation. A qualified ecologist will also regularly monitor the condition of each RA for the duration of the ten (10) year project, to ensure that the proposed planting and revegetation works satisfy the aims and methods of this Plan.

Within regeneration and revegetation areas a qualified ecologist will monitor the abundance of native species, weed abundance, any significant problems and the status of protective fences.

During the monitoring visits an assessment will be made of the health of the seedlings (growth rates, foliage status and survival rates) within revegetation areas to ensure that maintenance of planted individuals has occurred.

At the end of the final stage (end of Year 10) of the project, a qualified ecologist will determine if the stated objectives of this management plan have been achieved. If not, a report will need to be prepared identifying the works and the time frames required to ensure that the Regeneration and Revegetation Plan meets the stated objectives and that, most importantly, a self sustaining community is established within all the RA's.

## 2. MONITORING BASIC INDICATORS

Revegetated rainforest sites typically progress through two main stages: an initial 'establishment' phase and a longer-term 'building' phase. The 'establishment' phase is the period from when seeds or seedlings are planted until they have 'captured' the site, forming a relatively closed canopy and suppressing grasses and weeds. The establishment phase may last three to five years, depending on site conditions, planting design, maintenance, and so on.

In the 'building' phase, the planted trees mature, reproduce and eventually die, and other species of plants and animals are recruited to the site. In a restoration project, the aim of this phase is typically the development of a floristically and structurally diverse forest that provides habitat for native wildlife (Catterall *et al.* 2006). It may take decades or even centuries for a revegetated site to come to resemble mature rainforest.

The monitoring of basic indicators involves the survey of various aspects of vegetation structure on defined transects and plots, using a standard design. Kanowski and Catteral (Eds 2006) list the following basic indicators (**TABLE 1**) which have been identified from research conducted by the Rainforest CRC on the biodiversity values of reforested sites in tropical and subtropical Australia, and from other relevant work.

**TABLE 1 - LIST OF ATTRIBUTES TO BE SURVEYED**

| Attributes | Definition |
|---|---|
| Canopy Cover | Projective cover (%) of vegetation >2 m above ground (= shade cast by vegetation >2m above ground, if sun was directly overhead). |
| Canopy Height | Height attained by the crown of the tallest tree in the canopy. The canopy is the layer of foliage forming the 'roof' of the forest; it may be broken by gaps or incomplete. In some sites, it may be necessary to distinguish canopy trees from emergents (i.e. trees projecting above canopy with crowns exposed on all sides). |
| Ground Cover | Proportion of ground (%) covered by (a) vegetation <1 m high (score for each of: grass, herbs, ferns, vines and scramblers, trees and shrubs, moss), (b) leaf litter and fine woody debris, (c) coarse woody debris, (d) rock, (e) soil, (f) other. |
| Trees | Live freestanding woody-stemmed plants >2 m high. Trees are assessed by dbh class<br>(= stem diameter at 1.3 m above ground): <2.5 cm, 2.5-10 cm, 10-20 cm, 20-50 cm,<br>50-100 cm, >100 cm. |
| Structural damage to trees | Any significant structural damage to live trees from storms or cyclones is recorded as: 1 = defoliation and smaller branches broken; 2 = larger branches broken, 3 = trunk broken; 4 = tree pushed over at >45$^{o}$ angle or uprooted. |
| Standing dead trees (stags) | Dead freestanding woody-stemmed plants >2 m high, assessed by dbh class: <2.5 cm, 2.5-10 cm, 10-20 cm, 20-50 cm, 50-100 cm, >100 cm. |
| Shrubs | Live freestanding woody stemmed plants 1-2 m high. |
| Special life forms | Plant life forms characteristic of rainforest and/ or particular forest types.<br>Includes: strangler figs, hemi-epiphytes, vines ('slender' <5 cm diameter, 'robust' >5 cm diameter), vine towers, vine tangles, thorny scramblers, clumping epiphytic ferns, other epiphytes, tree ferns, ground ferns, palm trees, understorey palms, cordylines, herbs with long, wide leaves, herbs with strap leaves, cycads (with stems or on ground), other life forms characteristic of a site. |
| Coarse woody debris | Fallen logs and branches, lying on or within 2 m of the ground and >10 cm diameter. Where present, coarse woody debris usually comprises most of the volume of woody debris. Provides stable habitat for organisms dependent on rotting wood, as the core tends to remain moist. |

# 3. TIMING OF MONITORING VISITS

The monitoring is to be completed by a qualified ecologist. Site visits should occur for each RA as follows:

- Six (6) weeks after primary weeding;
- Six (6) weeks after initial plant-out;
- Every three (3) months thereafter until plants are sufficiently established; and
- Every six (6) months until project is completed.

# 4. REPORTING OF MONITORING RESULTS

Following each inspection by the qualified ecologist, a brief report will be prepared. At the end of each year a detailed report will be prepared and will discuss the following:

- Works undertaken;
- Progress of regeneration/revegetation areas;
- Significant problems encountered (death of seedlings, broken fences, vandalism etc.) and the effect of these on the plantings and aims of the revegetation strategy;
- Success or failures of measures implemented to rectify previously identified problems; and
- Measures to be taken to rectify new problems.

# 5. COMPLETION OF REPORTING

At the end of the final stage of the project, a qualified ecologist will determine if the stated objectives of the revegetation strategy have been achieved (or close to being achieved). If not, a report will be prepared to identifying the works and the time frames required to ensure that the stated objectives are fulfilled.