ENVIRONMENTAL
TRAINING & EMPLOYMENT INC.
EnviTE NSW

VEGETATION MANAGEMENT PLAN

WESTERN CHILLCOTTS CREEK LANDCARE

Environmental TRUST

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1 INTRODUCTION

1.1 Background

During 2001 Environmental Training and Employment Inc. (EnviTE nsw) received Environmental Trust funding to assist Landcare and Dunecare groups within the Ballina Shire. This enabled EnviTE to provide guidance with management plans and training for group members in regeneration techniques and plant identification skills for both native and exotic species. Alstonville Garden Club and the Tidy Towns Committee have been active at Western Chillcotts Creek for many years and EnviTE aims to further their endeavours by stimulating residents interest in the site and facilitate formation of an active group to rehabilitate and maintain the site as an area with aesthetic value to all residents.

1.2 Aims and Objectives

The aims of this report are:

- To develop a strategy for the regeneration of the riparian sub-tropical rainforest community which originally occurred at the site.
- Facilitate the rehabilitation of valuable flora and fauna habitat within the Alstonville district.
- To present a plan for work which is complimentary to that being carried out downstream on Chillcotts Creek, so as to reduce the possibility of reinfestation of exotic species along the entire catchment.

The objectives of this project include:

- Liasing with residents in regards to proposed activities and to facilitate group formation, structure and function.
- Development of a plan for the gradual and systematic removal of weed species from the site to encourage their replacement with native species.
- Determining a strategy for planting of appropriate species in areas where natural regeneration is least likely to occur. Plantings will expand and link patches of vegetation at the site.

2 DESCRIPTION OF THE STUDY AREA

2.1 Location, Remnant size, Context, Site History and Tenure

Western Chillcotts Creek is an area of urban bushland on Chillcotts Creek bounded by Valley Drive and Cedar Close, Alstonville, which is community land under the management of Ballina Shire Council. The remnant has a total size of approximately 10 hectares. The site provides an opportunity to rehabilitate an area of native bushland, offering not only important habitat for local flora fauna, but also an environmental resource for the community with aesthetic and passive recreational value.

2.2 Climate, Topography and Soils

North eastern New South Wales experiences a warm temparate to sub-tropical climatic regime that is generally characterised by a warm, moist summer and autumn to a mild dry winter and a warm, dry spring. Average rainfall in the area ranges from 1300-2000mm per year (NSW Agriculture).

According to Nicholls and Tucker (1956), the parent material of the soil type here is basalt produced by activity in the Mt. Warning volcano, some 20 million years ago. Formation of a deep, well structured red clay-loam soil, known as Krasnozem, has resulted from weathering of this material which is common to the Alstonville plateau. The aspect of the site slopes gently to the east.

2.3 Original Vegetation Type and Site History

This area was part of the Big Scrub rainforest, originally covering over 75,000 hectares of land east and north of Lismore. It was the largest area of lowland subtropical rainforest on the continent and one of the most biologically diverse in the world. Rapid deforestation followed European settlement and by the turn of the century much of the Big Scrub had been reduced to a series of isolated remnants that comprise less than 1% of the original vegetation. Other remnants of the Big Scrub rainforest occur downstream on Chillcotts Creek, at the NSW Agriculture Research station, where EnviTE has carried out restoration work over the past four years. Other Big Scrub remnants found nearby include Lumley Park, Maguires Creek and Victoria Park and Davis Scrub Nature Reserves.

The Western Chillcotts Creek area was originally cleared and used as paddocks until the housing estate was developed in the early 1980's. The site was maintained by Alstonville Garden Club and Alstonville Tidy Towns Committee from the late 1980's when a major planting of the Palms and rainforest species was undertaken by Alstonville Public, St Josephs and Alstonville High Schools. Since 1998 EnviTE Work For the Dole groups have assisted the efforts of Alstonville Garden Club with weed control and further rainforest plantings. A council pumping station pumps effluent to the Teven Road treatment works.

On 6/8/01 a meeting between local residents, Ballina Shire Council, Richmond Landcare Inc and staff from EnviTE took place to determine an ongoing group structure and a plan for site. From that meeting Western Chillcotts Creek Landcare group was formed and operates under the umbrella of Alstonville Ratepayers Association Landcare group.

3 VEGETATION AT THE SITE.

3.1 Native Vegetation

Native plants on this site occur as both, naturally occurring remnant vegetation, near the boundary with NSW Agriculture and planted species along the upper reaches of the creek. Specht classification of the naturally occurring vegetation here shows a dominant vegetation class of tall closed forest, with a cover of 70-90% and a tree height to 30 metres. Dominant trees are *Ealeocarpus grandis* (Blue Quondong) *Dysoxylum mollisimum* (Red Bean) and *Toona cilliata* (Red Cedar). The effects of disturbance at this site may be observed, with the complex structure of sub-tropical rainforest absent and replaced by a simple structure of a canopy with a ground cover of *Oplimenus sp* (Basket Grass) and ferns, with scattered rainforest shrubs and seedlings. Two smaller patches of remnant vegetation may be seen beside the creek downstream from the pump.

The plantings in the upper creek area consist, most notably, of the community of *Archontopheonix cunninghamiana* (Bangalow Palm) and Blue Quondong, where an understorey of rainforest pioneer species, such as *Mallotus phillipensis* (Red Kamala), *Jagera pseudorhus* (Foambark) and *Guioa semiglauca* (Guioa) is regenerating below the canopy. Other plantings have been made along the creek and on the hillside leading up to Valley Drive. These include *Araurcia cunninghamiana* (Hoop Pine), *Flindersia schottiana* (Cudgerie) and *Brachychiton acerifolious* (Flame Tree). Further to these, a stand of *Eucayptus sp* has been planted at the top of the creek. A list of native plants occurring at this site may be found in Appendix 2.

3.2 Weed Species

A wide range of exotic species occur within the reserve. Large areas of the creek are covered by a thick ground cover of *Impatiens walleriana* (Impatiens), which is choking the creek and smothering the regeneration of native trees.

Anredera cordifolia (Madiera Vine), *Asparagus plumosus* (Climbing Asparagus Fern) and *Lantana camara* (Lantana) are three serious climbing weeds which threaten to dominate the site if not controlled. Dunphy (1991) describes Madiera Vine as potentially the most destructive weed in north coast rainforests, with the ability to cover the canopy and degrade whole ecosystems, while Lantana has the potential to change conditions to its own benefit by restricting germination of native seedlings, smothering and deflecting the growth of natives and by altering leaf litter and leachates, which alter soil structure and nutrient levels. (Lamb 1995).

Cinnamomum camphora (Camphor Laurel*)* is another major weed found here, competing with native trees for nutrient, moisture and light. Large specimens may produce up to 50,000 seeds each year, affecting the diet of native birds, which disperse the seed throughout the district.

Other weeds found at this site include *Ageratina riparia* (Mist Flower), *A. adenophora* (Crofton Weed) and *Ageratum houstonianaum* (Blue Billy Goat Weed). These are found mainly in the moist, shaded areas along the watercourse where their dense cover restricts germination of natives and competes with the native ground covers such as *Pollia crispata*, which occurrs naturally in these wetter areas.
Many other exotic shrubs and trees such as *Cestrum nocturnum* (Night Flowering Cestrum) and *Tabebuia chrysantha* (Tabebuia) are found through out the site. Mostly these are garden escapes from nearby houses. A complete list of weeds identified at this site may be seen in Appendix 3.

3.3 Problems and Impacts on the Site

Although land management practices carried out here in the past such as clearing, grazing and subsequent neglect, have contributed to the degradation of the site which is now evident, it is felt that the impacts of urbanisation have been a major cause of the current situation. The construction of the nearby housing estates and the paved roadways around it, concentrate flows to drains leading into the site. Further to this, blockage on the fence line with NSW Agriculture and siltation of the creek, with excessive weed growth, restricts the flow away from the site, resulting in areas staying wet and boggy for long periods of time, a situation benefiting the Impatiens which proliferates in the moist, shady conditions.

Another cause of the degradation at this site is the garden escapes from surrounding houses. These may move on to the site by means of natural vectors such as birds, bats and rodents which consume the brightly coloured fruits, or by the dumping of garden refuse which contain propagules such as fruits or stems capable of taking root and establishing in their new setting. The confined nature of the outbreak of Madiera Vine in Zone A indicates this is the most likely form of introduction of this weed onto the site. Another common method of weed introduction is well-meaning gardeners who take pity on ailing pot plants and release them to the wild. Whatever the method of introduction, as conditions have become more beneficial to exotic species, they have proliferated and with the passage of time, turned conditions to further to their own benefit.

4 MANAGEMANT STRATEGY

For descriptive purposes the site may be broken into four main zones. These relate to the pump station, the creek and the streets surrounding the reserve, dividing the site into small, easily managed areas.

Zone A: Covers the area of the creek upstream from the pump and up the hillside to Valley Dr. It contains mainly planted rainforest species and the of stand of Eucalypts planted in the upper reaches. It is understood that council will continue to mow the grassed areas surrounding the zone.

Work in this zone should begin with the control of the Madiera Vine and Wandering Jew and continue with the systematic removal of all exotic species along the creek and on the adjacent hillside, so as to reduce the re-infestations occurring downstream in the future. Care should be taken not to contaminate water when spraying Impatiens around the creek, as aquatic and amphibious fauna can be susceptible to spray drift. Spraying should be restricted to dry periods and confined to dry patches of ground. Areas within this zone where spraying has already taken place have responded well to the treatment, however, regular maintenance of this area must continue to avoid the return of this weed.

Zone B: Covers the area from the access road to Cedar Close. The canopy consists mainly of mature Camphor Laurel, with a mixed understorey of rainforest seedlings and various weed species. Many exotic species have been introduced here in gardens established by nearby residents. Consultation will be necessary to decide the future of such gardens. Weeds should be controlled in the understorey before Camphors are systematically stem injected. Trees killed in this way should be left to gradually decompose. Birds find the branches an appealing perch spot and assist the regeneration of native species by dispersing seeds.

Zone C: is located below the pump station on the southern hillside up to Valley Drive. Native vegetation here consists of plantings, which have previously been carried out and two small stands of remnant trees. During 2001, the southern edge of this zone above the pump was disturbed by the mechanical removal of Camphor Laurels. Along this edge many pioneer rainforest seedlings such as *Trema aspera* (Pioson Peach) and *Commersonia bartramia* (Brown Kurrajong) have germinated together with various weed species. Control of these weeds should see the establishment of a thick edge of rainforest species, which can protect the reserve against further weed invasion by the formation of a physical barrier, able to resist the movement of wind borne weed seed, protection against drying or destructive winds which can lead to changes in temperature and humidity.

Many weeds, however, have invaded and dominate the lower areas of the zone. The creek flat is heavily infested with Impatiens and Lantana and is in need of comprehensive weed control to allow the regeneration process to begin. The area surrounding the pump station is heavily covered with weeds and would benefit from the planting of suitable rainforest species following their control. A patch of Madiera Vine in this zone should be controlled as a priority and smaller outbreaks around the creek treated and monitored to avoid further spread of this major weed.

Zone D: Contains the best stand of remnant vegetation at this site, however *Asparagus plumosus* (Climbing Asparagus Fern) and *Ligustrum sinensis* (Small Leaf Privet) are beginning to take hold here and should be treated to avoid a major infestation. The canopy

contains many mature rainforest trees, but lacks the complex structure typical of subtropical rainforest. Removal of weed species here would allow the development of a middle strata and a more robust rainforest community which may be able to resist further infestation of weeds.

5 OTHER MANAGEMENT RECOMMENDATIONS

In order to implement a successful regeneration program in this reserve a long term commitment to the project needs to be adopted by local residents and Ballina Shire Council. Continued operation of a local Landcare group provides financial and technical assistance to the project and allows the necessary tools, herbicide and trees to be made available for use to group members. Assistance for the project may be gained by approaching various labour market programs such as Work For The Dole or Green Corps. It is felt that developing a well organised approach to the project and adherence to a common plan will result in successful outcomes at this site. Ad hoc work by individuals may produce poor results, disappointment in the outcomes and abandonment of the project.

Bushland regeneration projects typically proceed through three main stages. The initial stage or primary work is the most labour intensive where the bulk of the weeds are controlled. This is the stage where some hard work and a good sense of humour may be required by participants. Although it may appear as though progress is slow, the establishment of manageable areas, free of weeds, is important for the regeneration processes to begin.

The next stage is regular follow up work throughout these areas. This stage may be frustrating as the urge to press on and open up new areas is strong, however a pattern of “two steps forward, one step back” will remove weeds missed during the primary stage and also control seedlings which have germinated in the ensuing period. Often during this period, hand removal of shrubby weeds is replaced by spraying out ground covers, which have invaded the disturbed soil with great care needed to avoid accidentally destroying emerging native seedlings. This stage requires less of the vigorous labour and offers some rewards to the group as the beginning of the regeneration processes are observed.
The final, and on going, stage is regular maintenance of the site. This stage offers the most reward for the group with the lowest labour input. With the site divided into manageable zones, group members can keep any returning weeds under control by hand removal of small seedlings during regular work days or while enjoying a stroll through the site. While it is unrealistic to assume that a weed free reserve will result from the weed control work carried

out, weeds removed at this stage are easily managed and regular attention from residents should see strong regeneration of native vegetation.

To achieve effective and sustainable restoration of native vegetation communities, it is necessary to consider the complex ecological interactions that occur within these communities. Bush Regeneration work should focus on systematically working an area to promote conditions allowing the re-establishment of native species to the disadvantage of exotic species. Weed control should not target particular weed species, but should focus on gradual and systematic removal of all weed species.

Target removal of a particular weed can lead to replacement with other weeds or juveniles of the species just removed and a further decline in the health of the vegetation community. For example, if all canopy Camphor Laurels are stem injected at once and other weeds are left on site, the increased availability of light, nutrients, space and water is likely to be taken up by other weeds. An increase in the growth of juvenile Camphor Laurels seedlings and other weeds may well occur.

When carrying out restoration works it is particularly important not to jump ahead or move off course from the direction that has been chosen. Small areas of work in a number of locations are prone to rapid reinfestation from surrounding weeds. Using a systematic approach, a weed free area can be maintained and enlarged. It is recommended that a professional bush regenerator be involved in implementation of weed control works, species selection and lay out for replanting.

5.1 Monitoring

It is important to monitor the project through “before and after” photography. This provides a record of progress that will prove useful to attract further funding and identify successful techniques, as well as providing reassurance for volunteers that their work has been useful. The slow success of rehabilitation works is best seen when specific photo points are established during the initial stages of the project and continually used. Photo points should be identified with a permanent marker(some sort of stake or picket) and taken consistently of the same site from the same direction. This can be established by referring to past photos prior to taking each photo. Photographic records should be taken at least seasonally (ie. Three to six monthly) and after major events, such as big plantings, storms or firers.
Records of working bees, including attendance, activities undertaken, weather constraints, success and failures etc. Are also invaluable monitoring tools. An example of a work sheet is included as Appendix 4.

Another important aspect of monitoring is maintaining species lists. The native and weed list in this plan (Appendices 1&2) should be continually updated as new species are encountered. It is also useful to establish a faunal species list for the site. This information, where relevant, should be shared with land managers such as Ballina Shire Council, Department of Land and Water Conservation and the NPWS.

A stock list of tools and materials which may be required for bush regeneration projects may be found in Appendix 5, while control methods and techniques for commonly encountered species is found in Appendix 6

6 TREE SELECTION GUIDELINES

It is important when selecting plants for this site that the species chosen are ones that either occur or would have occurred naturally in the area. It is also important to plant a high diversity of species, particularly as riparian land often supports such a high diversity of plants.

Appropriate species would also include native shrub and understorey species. (See Appendix 7)

The maintenance of genetic integrity must also be considered when planning a planting. Although a species may have a very broad geographic range such as the Common Lilly-Pilly, it will exhibit obvious or subtle differences in its physiology and adaptation over this range. A plant grown from the local gene pool has adapted to that area. This does not mean that plants will need to be sourced from seed only from the immediate area but should be from within the Big Scrub zone or Richmond catchment. It is also worth noting that seed collected from planted specimens of an unknown origin should be discouraged. This includes street trees, parks or other revegetation sites.

Local fauna species may also be dependent on the local plant varieties. The introduction of species that would not naturally occur on this site is therefore not recommended. This can be detrimental to the ecological functions of the plant community. If the aims of the restoration project are to facilitate the recovery of a rainforest riparian community, then planting trees, which do not belong, will detract from achievement of this aim.

7 SUMMARY OF MANAGEMENT RECOMMENDATIONS

Zone A

- Treat Madiera Vine and Wandering Jew outbreaks on N/W edge near Eucalypt planting.
- Systematically remove all exotic shrubs, trees and ground covers along creek and hillside.
- Control weeds to establish a healthy edge of rainforest trees between remnant and grassed section near houses in Valley Drive.
- Develop a suitable maintenance program to control Impatiens, exotic ground covers and emerging weed seedlings.

Zone B

- Liase with neighbours to determine the future of gardens below Camphor Laurels in reserve.
- Comprehensive weed control in the understorey
- Stem inject selected Camphor Laurels. Approximately 30% each year.
- Regular follow up maintenance and monitoring

Zone C

- Treat Madiera Vine outbreak on S/E edge of zone and around creek crossing.
- Systematic removal of exotic shrubs and trees on creek edge and hillside.
- Plant suitable species in area adjacent pump station.
- Regular follow up maintenance and monitoring.

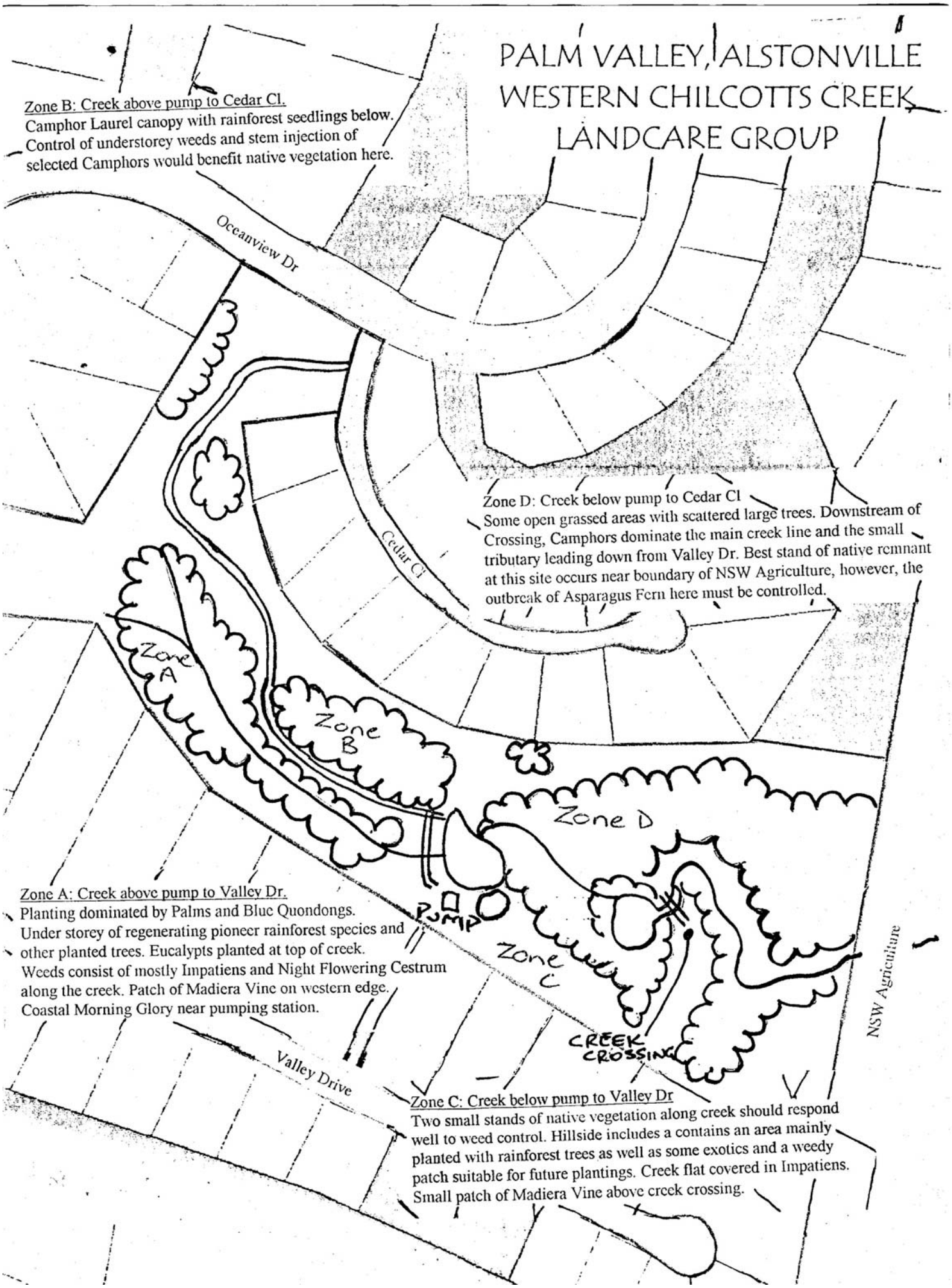
Zone D

- Control Climbing Asparagus Fern and understorey shrubs.
- Control and monitor minor Madiera Vine outbreaks.
- Stem inject selected Camphor Laurels. Approximately 30% each year.
- Regular follow up maintenance and monitoring.

8 CONCLUSION

The native vegetation at this location has been degraded by poor management practices in the past, invasion of weed species and changes to hydrology in the surrounding area. While it can be seen that the site will continue to deteriorate in the current situation, it is felt, that with a long term commitment to a systematic and flexible weed control program by residents, the landcare movement and council, the site has sufficient resilience potential to respond favourably, and that the environmental values of this native plant community may be enhanced for the future benefit of the community as a whole.

APPENDIX 1 SITE MAP



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APPENDIX 2 NATIVE PLANT SPECIES

Western Chillcotts Creek Alstonville

P= Planted tree

Trees & Shrubs N= Naturally occurring

FAMILY	SCIENTIFIC NAME	COMMON NAME	
Arecaceae	Archontophoenix cinninghamiana	Bangalow Palm	P,N
	Linospadix monstychyus	Walking Stick Palm	N
Araucariaceae	Araucaria cunninghamii	Hoop Pine	P
	Araucaria bidwilli	Bunya Pine	P
Asteliaceae	Cordyline petiolaris	Broad-leaved Palm Lily	N
	Cordyline stricta	Narrow-leaved Palm Lily	N
Elaeocarpaceae	Elaeocarpus grandis	Blue Quondong	P,N
	Elaeocarpus obovatus	Hard Quondong	N
	Elaeocarpus reticulatus	Blue Berry ash	P
	Sloanea australis	Maidens Blush	N
Euphorbiaceae	Breynia oblongifolia	Breynia	N
	Bridelia exaltata	Brush Ironbark	P
	Glochidion sumatranum	Umbrella Cheese Tree	N
	Macaranga tanarius	Macaranga	P
	Mallotus discolor	Yellow Kamala	N
	Omalanthus populifolius	Bleeding Heart	N
Cunoniaceae	Callicoma serratifolia	Callicoma	N
Fabaceae			
s.f. Mimosoideae	Acacia melanoxylon	Blackwood	N
	Pararchidendron pruinosum	Snow Wood	N
s.f. Fabiodiae	Castanosporum australe	Black Bean	N
Lauraceae	Cinnamomum oliveri	Oliver's Sassafras	P
	Cryptocarya glaucescens	Jackwood	P
	Cryptocarya obovata	Pepperberry	N
	Cryptocarya triplinervis	Three-veined Laurel	N
	Neolitsea australiensis	Green Bolly Gum	N
	Neolitsae dealbata	White Bolly gum	N
Meliaceae	Dysoxylum mollissimum	Red Bean	N
	Dysoxylum fraserianum	Rosewood	N
	Dysoxylum rufum	Hairy Rosewood	N
	Melia azedarach	White Cedar	P
	Synoum glandulosum	Scentless Rosewood	N
	Toona ciliata	Red Cedar	N
Monimiaceae	Daphnandra sp.	Socketwood	N
	Wilkea huegeliana	Veiny Wilkea	N
Moraceae	Ficus coronata	Creek Sandpaper Fig	N
	Ficus macrophylla	Moreton Bay fig	N
	Ficus watkinsiana	Strangler Fig	N
Myrtaceae	Acmena smitii	Common Lilly Pilly	N
	Acmena ingens	Red Apple	P
	Eucalyptus tereticornis	Forest Red Gum	P
	Eucalyptus sp	Various planted species	P
	Rhodamnia rubescens	Scrub Turpentine	N
	Pilidiostigma glabrum	Plum Myrtle	N
	Syzygium australe	Brush Cherry	P
	Syzygium oleosum	Blue Lilly Pilly	N
Oleaceae	Notelaea longifolia	Large Mock Olive	

Pittosporaceae	Hymenosporum flavum	Native frangipani	P
	Pittosporum undulatum	Native Daphne	N
	Pittosporum revolutum	Hairy Pittosporum	N
Podocarpaceae	Podocarpus elatus	Plum Pine	P
Proteaceae	Grevillea robusta	Silky Oak	P
	Macadamia tetraphylla	Bush Nut	
	Stenocarpus sinuatus	Firewheel Tree	P
Rhamnaceae	Alphitonia excelsa	Red Ash	N
Rutaceae	Acronychia oblongifolia	Common Acronychia	P
	Flindersia australis	Teak	P
	Flindersia schottiana	Cudgerie	P,N
	Flindersia xanthoxyla	Yellow Wood	P
	Melicope elleryana	Pink Euodia	P
	Pentacerus australis	Crows Ash	N
Sambucaceae	Sambucus australiasica	Native Elderberry	N
Sapindaceae	Alectryon tomentosus	Hairy Alectryon	N
	Arytera distylis	Twin-leaved Coogera	N
	Cupaniopsis anacardioides	Tuckeroo	P
	Diploglottis australis	Native Tamarind	P,N
	Guioa semiglauca	Guioa	N
	Harpulia pendula	Tulipwood	P
	Jagera pseudorhus	Foambark	N
	Sarcopterxy stipata	Steel Wood	N
Solanaceae	Doboisia myoporoides	Corkwood	N
Sterculiaceae	Argyrodendron trifoliolatum	White Booyong	P
	Brachychiton acerifolius	Flame Tree	P
	Commersonia bartramia	Brown Kurrajong	N
Thymeleaceae	Wikstroemia indica	Wikstroemia	N
Ulmaceae	Aphananthe philippinensis	Rough-leaved Elm	N
	Trema tomentosa	Poison Peach	N
Urticaceae	Dendrocnide photinophylla	Shiny-Leaved Stinging Tree	N
Verbenaceae	Clerodendron tomentosum	Hairy Clerodendrum	N
	Gmelia leichhardtii	White Beech	P

Climbers

Cucurbitaceae	Diplocyclos palmatus	Native Bryony	N
Luzuriagaceae	Eustrephus latifolius	Wombat Berry	N
	Geitonoplesium cymosum	Scrambling Lily	N
Menispermaceae	Stephania japonica	Snake Vine	N
Moraceae	Maclura cochinchinensis	Cockspur Thorn	N
	Malasia scandens	Burney Vine	N
Rosaceae	Rubus parvifolius	Native Raspberry	N
	Rubus hillii	Native Raspberry	N
Smilacaceae	Smilax australis	Austral Sarsaparilla	N
Vitaceae	Cayratia clematidea	Slender Grape	N
	Cissus antarctica	Native Grape	N

Grasses and Forbs

Acanthaceae	Pseuderanthemum variabile	Pastel Flower	N
Apiaceae	Centella asiatica	Gotu Kola	N
Araceae	Alocasia brisbanensis	Cunjevoi	
Convolvulaceae	Commelina cyanea	Blue Commelina	N
	Dichondra repens	Kidney Weed	N
	Pollia crispata	Pollia	N
Geraniaceae	Geranium sp	Native Geranium	N
Lobeliaceae	Pratia purpuracens	White Root	N
Phormiaceae	Dianella sp.	Blue Flax Lily	N
Poaceae	Oplismenus aemulus	Broad Basket Grass	N
	Oplismenus imbecilis	Narrow Basket Grass	N
Zingiberaceae	Alpinia caerulea	Native Ginger	N

Ferns

Adiantaceae	Adiantum hispidulum	Native Maidenhair	N
Aspleniaceae	Asplenium australasicum	Birds Nest Fern	N
Blechnaceae	Doodia aspera	Rasp Fern	N
Dennstaedtiaceae	Pteridium esculentum	Bracken Fern	N
	Platycerium	Elkhorn /Staghorn	N
Davalliaceae	Davallia pyxidata	Hare's Foot Fern	N

APPENDIX 3 WEED SPECIES

Trees & Shrubs

FAMILY	SCIENTIFIC NAME	COMMON NAME
Arecaceae	Syagrus romanzoffianum	Cocos Palm
Araliaceae	Schefflera actinophylla	Umbrella tree
	Jacaranda mimosifolia	Jacaranda
Bignoniaceae	Tabebuia chrysantha	Tabebuia
Fabaceae		
s.f. Caesalpinoideae	Senna pendula var. glabrata	Winter Senna
	Senna x floribunda	Smooth Senna
Lauracea	Cinnamomum camphora	Camphor Laurel
Myrtaceae	Psidium guajava	Guava
	Eugenia uniflora	Brazillian Cherry
Ochnaceae	Ochna serrulata	Ochna
Oleaceae	Ligustrum lucidum	Large-leaved Privet
	Ligustrum sinense	Small-leaved Privet
Pinaceae	Pinus elliottii	Slash Pine
Rubiaceae	Coffea arabica	Coffee
Rutaceae	Murraya paniculata	Murraya
Sapindaceae	Koelrueteria bipinnata	Golden Rain Tree
Solanaceae	Cestrum nocturnum	Night Flowering Cestrum
	Cestrum parqui	Green cestrum
	Solanum mauritianum	Tobacco Bush
	Solanum seaforthianum	Climbing Nightshade
Ulmaceae	Celtis occidentalis	Hackberry
Verbenaceae	Lantana camara	Lantana

Climbers

Asparagaceae	Asparagus plumosus	Climbing Asparagus Fern
Basellaceae	Anredera cordifolia	Madiera Vine
Convolvulaceae	Ipomea cairica	Coastal Morning Glory
Oleaceae	Jasminum polyanthum	Jasmine
Passifloraceae	Passiflora edulis	Edible Passionfruit
	Passiflora suberosa	Corky Passionfruit
	Passiflora subpeltata	White Passionflower
Solanaceae	Solanum seaforthianum	Brasilian Nightshade

Groundcovers

Asparagaceae	Asparagus aethiopicus	Ground Asparagus
Asteraceae	Ambrosia artemisiifolia	Ragweed
	Ageratina adenophora	Crofton Weed
	Ageratina riparia	Mistflower
	Ageratum houstonianum	Billy Goat Weed
	Bidens pilosa	Farmer's Friends
	Conyza albida	Tall Fleabane
	Senecio madagascariensis	Fireweed
	Tagetes minuta	Stinking Roger
Cannaceae	Canna indica	Indian Shot, Canna
Commelinaceae	Tradescantia albiflora	Trad, Wandering Jew
	Zebrina pendula	Varigated Wandering Jew
Davalliaceae	Nephrolepis cordifolia	Fishbone Fern
Malvaceae	Sida rhombifolia	Paddy's Lucerne
Plantaginaceae	Plantago lanceolata	Plantain
Poaceae	Chloris guayana	Rhodes Grass

	Melinus repens	Red Natal Grass
	Paspalum dilatatum	Paspalum
	Paspalum urvillei	Giant Paspalum
	Pennisetum clandestinum	Kikuyu
	Sporobolus sp	Parramatta Grass
Solanaceae	Solanum nigra	Blackberry Nightshade
Verbenaceae	Verbena bonariensis	Purple Top

APPENDIX 4 DAILY WORK SHEET

Western Chillcotts Creek Alstonville

Work Team

Name	Signature

Weather conditions

Areas worked, description of work undertaken and comments (include relevance to site of works, methods used or trialed or the state of the remnant. Use back of form for site sketch and additional comments

Weeds treated	Methods	Chemical and application rates

Chemical	Volume used

APPENDIX 5 TOOLS AND EQUIPMENT REQUIRED

Non-consumables

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

Consumables

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

APPENDIX 6 CONTROL METHODS FOR WEED SPECIES

1. **"Cut-scrape-paint"**: this method applies to all woody shrubs, trees and some vines.

(a) Cut plant low to the ground at an angle.
(b) Apply Glyphosate immediately at the rate of 1 part Glyphosate: 1.5 parts water, with a paintbrush approximately 1.5 centimetres wide.
(c) Scrape sides lightly to reveal green tissue and apply the herbicide to the scraped area.
(d) Take care that the brush is not contaminated with soil.

Note: all seed that has high viability and longevity, e.g. *Senna* spp. and other members of the Fabaceae family, or plants with a high invasive potential, such as *Schefflera actinophylla,* must be removed from the parent and either composted on site or removed from the site.

2. **"Gouge-paint"**: this method applies to those plant species that have a fleshy root system, such as rhizomes or large bulbs. It is particularly appropriate for the treatment of *Protasparagus* spp. (Asparagus).

(a) Gouge out sections of the fleshy base with a knife (if using on Asparagus, first cut the stems at shoulder height and also at the base).
(b) Apply 1 part Glyphosate: 1.5 parts water immediately, with a paint brush approximately 1.5 centimetres wide.

3. **"Stem Injection":** this method applies to all woody trees and shrubs with a diameter of about six to ten centimetres or greater.

(a) With a tomahawk, make a cut the width of the blade, at a slight angle, into the trunk. **Note:** it is important not to make cuts too deep.
(b) Apply herbicide immediately into the cut using a tree-injecting device (if using Glyphosate, apply at the rate of 1 part Glyphosate: 1.5 parts water*)*.
(c) Repeat this procedure in a brickwork pattern around the circumference of the tree, as close to the ground as possible. Where the presence of a crotch angle makes this difficult, make a cut above it. **Note:** two rows of cuts will be sufficient for trees with trunks of six to ten centimetres; larger trunk diameters will need correspondingly more.
(d) Treat all visible lateral roots as per (a).

4. **"Scrape-ditch-paint":** this method is applicable to many species of vines where it is desirable to treat the vines intact, particularly those with aerial tubers such as *Anredera corifolia* (Madeira Vine) or those which will propagate from segments, e.g. *Delairia odorata* (Cape Ivy).

(a) Scrape the stem tissue on one side of the stem only for at least 20-30 centimetres if possible. **Note:** on Madeira Vine, it is necessary to scrape heavily. Scrape as many sections of the stem as possible.
(b) Apply undiluted Glyphosate with a paintbrush.
(c) On stems that are thicker or horizontal, make a ditch into the stem with a knife and apply herbicide. Tubers and side roots should be treated the same way. **Note:** care must be taken not to sever the stem.

5. **"Spraying":** this is carried out using a 15 litre backpack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used with the addition of a marker dye. For plants that show some resistance (e.g. Madeira Vine) or where growing conditions are not optimal, an acidifying agent, LI700®, is added. Metsulfuron can also be used for resistant species and grasses. It should be used with a surfactant, such as Agral®.

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

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

- Plants with more or less succulent leaves, *e.g. Tradescantia fluminensis, Anredera cordifolia* (autumn to winter is the suggested time for spraying these plants), *Chlorophytum* spp. etc.
  1 part Glyphosate: 50 parts water + LI700® 0.5%
- *Lantana camara*
  1 part Glyphosate: 100 parts water
- Other soft-leaved plants, annuals and grasses
  1 part Glyphosate: 100 parts water
- *Chrysanthemoides monilifera* subsp. *rotundata*
  1 part Glyphosate: 150 parts water to 1 part Glyphosate: 400 parts water

Dilution Rates (Metsulfuron: water):

- 1.5g Metsulfuron: 10 litres water + 20 millilitres Agral®: 10 litres water

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

(a) Spray over the top of the infestation, using a weak solution of Glyphosate.
Note: any native plants that may be under the weed will be protected by the foliage cover of the weed.

(b) Leave the sprayed plants intact so that native seedlings can establish under the shelter provided.

Note*:* Lantana – 1 part Glyphosate: 100 parts water
Bitou Bush – 1 part Glyphosate: 150 parts water to 1 part Glyphosate: 400 parts water

Alternatively: weeds can be cut and flattened with bush-hooks or loppers and the subsequent regrowth sprayed with Glyphosate.
Note: in many cases it is preferable to overspray wherever practicable as this will cause less erosion and trampling of suppressed native plants, such as ferns and seedlings. However, handwork will be necessary to "cut-scrape-paint" any unsprayed Bitou Bush or Lantana that surrounds native plants.

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

(a) Grasp the leaves or stems and hold them tightly so that the base of the plant is visible. Plants with sharp leaves or stems should be cut back first.

(b) Insert the knife close to the base of the plant at a slight angle, with the tip well under the root system.

(c) Cut through the roots close to the base. Depending on the size of the plant, two or more cuts may be needed to sever all the roots.

(d) Remove the plant. Make sure that the base of the plant where the roots begin is completely removed.

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

Trees and Shrubs

Scientific Name	Common Name	Control Method
Agave sp.	Yucca	Han pull young plants where possible. Cut larger plants near the ground and cut-scrape-paint **1:1.5.** Remove all material form site.
Araucaria heterophylla	Norfolk Island Pine	Do not treat.
Chrysanthemoides monilifera subsp. *Rotundata*	Bitou Bush	Hand pull young seedlings and hang up. Cut-scrape-paint **1:1.5** small plants. Overspray mature plants if no risk to native seedlings **1:200.**
Cinnamomum camphora	Camphor Laurel	Stem inject **1:1.5** larger trees. Cut-scrape-paint **1:1.5** small plants. Spray seedlings **1:50 + LI700**®.
Ficus elastica	Rubber Tree	Stem inject **1:1.5** larger trees. Cut-scrape-paint **1:1.5** small plants. Cut material will re-shoot if left on the ground.
Hibiscus rosa sinense	Hibiscus	Stem inject **1:1.5** larger trees. Cut-scrape-paint **1:1.5** small plants. Cut material will re-shoot if left on the ground.
Leptospermum laevigatum	Coast Tea Tree	Cut close to ground and bag seed.
Ochna serrulata	Mickey Mouse Bush	Cut-scrape-paint **1:1.5**. Spray seedlings **1:50 + LI700**®, difficult to hand pull, will regrow from broken root.
Opuntia stricta	Prickly Pear	Spray Metsulfuron **1.5g/10L** and Agral® **20mL/10L**. Bag seed.
Schefflera actinophylla	Umbrella Tree	Hand pull or spray seedlings **1:50 + LI700**®. Stem inject **1:1.5** larger trees. Cut-scrape-paint **1:1.5** small plants.

Vines and Scramblers

Scientific Name	Common Name	Control Method
Acetosa sagittata	Turkey Rhubarb	Hand remove plant and tuber. Bag tubers.
Gloriosa superba	Glory Lily	Hand remove plant and tuber. Bag tubers (highly poisonous). Treat in December and January when flowering.
Ipomoea cairica	Coastal Morning Glory	Hand pull, cut-scrape-paint **1:1.5**, roll up vines, spray **1:100 + LI700**®.
Macroptilium atropurpureum	Siratro	Hand pull, cut-scrape-paint **1:1.5.** Bag seeds.
Oenothera drummondii	Beach Primrose	Hand remove.
Protasparagus aethiopicus	Ground Asparagus	Hand remove (crowning of rhizome). Spray Metsulfuron **1.5g/10L** and Agral® **20mL/10L**.
Solanum nigrum	Black-berry Nightshade	Hand pull/ slash. Spray **1:100 + LI700**®.

Herbs, Ferns and Grasses

Scientific Name	Common Name	Control Method
Bryophyllum pinnatum	Resurrection Plant	Hand remove all plant parts where possible. Spray Metsulfuron **1.5g/10L** and Agral® **20mL/10L**.
Euphorbia cyathophora	Painted Spurge	Spray **1:100 + LI700**®. Hand pull.
Nephrolepis cordifolia	Fishbone Fern	Hand remove all plant parts where possible. Spray Metsulfuron **1.5g/10L** and Agral® **20mL/10L**.
Pennisetum clandestinum	Kikuyu	Spray **1:100 + LI700**®.
Sansevieria trifasciata	Mother-in-law's Tongue	Hand remove all plant parts where possible. Spray Metsulfuron **1.5g/10L** and Agral® **20mL/10L**.
Senecio madagascariensis	Fireweed	Hand pull.
Stenotaphrum secundatum	Buffalo Grass	Spray **1:100 + LI700**®.

Note: Unless otherwise stated the herbicide recommended for the techniques described above is Glyphosate e.g. Roundup®. LI700® should be used as per manufacturer's instructions. An off label permit is required from the National Registration Authority for any combination of herbicides or for rates not described on the product labels.

APPENDIX 7 LIST OF SPECIES FOR PLANTING SUB TROPICAL RIPARIAN SITES IN NORTHERN NSW

Trees

Species	Common Name
Acacia melanoxylon	Sally Wattle
Acmena ingens	Red Apple
Acmena smithii	Common Lilly Pilly
Acronychia oblongifolia	Common Acronychia
Alphitonia excelsa	Red Ash
Aphananthe philippinensis	Native Elm
Archontophoenix cunninghamiana	Bangalow Palm
Arytera distylis	Twin-Leaved Coogera
Baloghia inophylla	Scrub Bloodwood
Brachychiton acerifolius	Flame Tree
Bridelia exaltata	Scrub Ironbark
Caldcluvia paniculosa	Soft Corkwood
Castanospermum australe	Black Bean
Castanospora alphandii	Brown Tamarind
Cinnamomum oliveri	Olivers Sassafras
Clerodendrum floribundum	Smooth Clerodendrum
Commersonia batramia	Brown Kurrajong
Cryptocarya glaucescens	Jackwood
Cryptocarya obovata	Pepperberry
Cupaniopsis flagelliformis	Brown Tuckeroo
Dendrocnide excelsa	Giant Stinging Tree
Dendrocnide photinophylla	Smooth Stinging Tree
Diospyros pentamera	Myrtle Ebony
Diploglottis australis	Native Tamarind
Dysoxylum fraserianum	Rosewood
Dysoxylum mollisimum	Red Bean
Ehretia acuminata	Koda
Elaeocarpus grandis	Blue Quandong
Elaeocarpus kirtonii	Silver Quandong
Elaeocarpus obovatus	Hard Quandong
Ellatostachys nervosa	Green Tamarind
Endiandra pubens	Hairy Walnut
Ficus coronata	Creek Sandpaper Fig
Ficus fraseri	White Sandpaper Fig
Ficus macrophylla	Moreton Bay Fig
Ficus obliqua	Small Leaved Fig
Ficus superba	Deciduos Fig
Ficus virens	White Fig
Ficus watkinsiana	Strangler Fig
Flindersia australis	Teak
Flindersia schottiana	Cudgerie
Flindersia xanthoxyla	Yellow Wood
Geissos benthamii	Red Carabeen
Glochidion ferdinandi	Cheese Tree
Guioa semiglauca	Guioa
Heritiera trifoliolata	White Booyong
Hymenospermum flavum	Native Franjipani
Litsea australis	Brown Bolly Gum
Litsea reticulata	Bolly Gum
Macadamia tetraphylla	Queensland Nut
Mallotus discolor	Yellow Kamala
Mallotus phillippensis	Red Kamala
Melia azaderach	White Cedar

Melicope octandra	Doughwood
Mischocarpus pyriformis	Yellow Pear Fruit
Omalanthus populifolius	Bleeding Heart

Trees

Species	Common Name
Pararchidendron pruinosum	Snowood
Pentacerus australis	Crow's Ash
Pilidiostigma glabrum	Plum Myrtle
Pittosporum undulatum	Sweet Pittosporum
Planchonella australis	Black Apple
Podocarpus elatus	Plum Pine
Polyscias elegans	Celerywood
Rhodamnia argentea	Malletwood
Rhodomyrtus psidioides	Native Guava
Sarcopterix stipata	Steelwood
Sloanea australis	Maidens Bush
Sloanea woollsii	Yellow Carabeen
Stenocarpus sinuatus	Fire-wheel Tree
Streblus brunonianus	Whalebone Tree
Syzygium australe	Scrub Cherry
Syzygium corynanthum	Sour Cherry
Syzygium crebrinerve	Purple Cherry
Syzygium francissi	Giant Water Gum
Syzygium hodkinsoniae	Red Lilly Pilly
Syzygium leuhmanni	Riberry
Syzygium moorei	Coolamon
Toechima dasyrrhache	Blunt Leaved Steelwood
Toona ciliata	Red Cedar
Trema tomentosa	Native Peach
Tristaniopsis laurina	Water Gum

Shrubs

Species	Common Name
Actephila lindleyi	Actephila
Capparis arborea	Brush Caper Berry
Citriobatus pauciflorus	Orange Thorn
Cordyline rubra	Red-fruited Palm Lilly
Eupomatia laurina	Bolwarra
Randia benthamiana	Native Gardenia
Wilkiea autroqueenslandica	Smooth Wilkiea
Wilkiea heugeliana	Veiny Wilkiea

Herbs and Groundcovers

Species	Common Name
Alocasia brisbanensis	Cunjevoi
Alpinia caerulea	Native Ginger
Dianella caerulea	Flax Lilly
Elatostema reticulatum	Rainforest Spinach
Lomandra hystrix	Creek Mat-rush
Lomandra spicata	Rainforest Mat-rush