VEGETATION MANAGEMENT PLAN

WEST LAKE AINSWORTH, LENNOX HEAD

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SUMMARY

This plan, and a series of other plans for coastal sites in Ballina Shire, has been prepared with Coastcare funding. The plan provides practical guidelines for Lennox Head Dunecare and others on how to maintain the current diversity of endemic vegetation that is found on the western side of Lake Ainsworth in Lennox Head.

Lake Ainsworth is located at the northern extreme of the village of Lennox Head in Ballina Shire (northern New South Wales). The area addressed in this plan is defined by the lake, a picnic area, dune vegetation then the Coral Sea to the east, the northern end of the lake to the north, an unsealed road and area of extensive heathland to the west, and the Caravan Park to the south.

Site inspections for this plan were conducted on the 10th and 17th of October 2001 and the 14th February 2002, with an aerial survey carried out on the 2nd of August 2001. Vegetation communities on the western side of Lake Ainsworth can generally be described as coastal sclerophyll (heath), dominated by Banksia spp., with low-lying areas inhabited by Melaleuca wetland. It is predominantly a Melaleuca quinquenervia, Pellaea falcata association. Vegetation is quite healthy, although there is a lack of seedlings and juvenile specimens in some areas, and weeds are beginning to encroach on the site.

A number of management problems and recommended solutions are included in this plan. The vegetation on the western side of Lake Ainsworth is reasonably pristine and unaffected by many of the serious environmental weeds affecting other coastal areas in the Shire. A minimum of restoration activity is required to ensure the long term conservation and enhancement of the area.

There are many good reasons for doing this work including conservation of individual species and forest type, improved habitat for wildlife, and general public amenity. Environmental restoration can be very satisfying and the community/team interaction is renowned for forming long, trusting associations between individuals.
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1. INTRODUCTION

1.1 Background
This plan, and a series of other plans for coastal sites in Ballina Shire, has been prepared with Coastcare funding. The plan provides practical guidelines for Lennox Head Dunecare and others on how to maintain the current diversity of endemic vegetation that is found on the western side of Lake Ainsworth in Lennox Head. Vegetation at the site is relatively intact and differs little to how it would have appeared before European settlement. Although there is an informal bush track that meanders around the edge of the lake, few people use this area compared with the northern and eastern shores consequently, human impacts are low. The biggest threat to the study area is the encroachment of environmental weeds, some species of which are presently well established.

1.2 Aims and Objectives
The aim of this plan is to provide practical guidelines to enable groups and individuals, engaged in rehabilitating around Lake Ainsworth, to carry out works that will:
• maintain the resilience and regenerative capacity of the current native vegetation,
• reduce the potential for exotic plants, which can displace endemic species, to become established,
• provide a suitable habitat for local and migratory native fauna, and
• improve the general amenity of the area for local residents and visitors (aesthetic, recreational and educational).

The specific objectives of the plan and its recommended works are:
• to assess the extent and location of native plant and weed species,
• to make recommendations for the regeneration and rehabilitation of the vegetation on the western side of Lake Ainsworth, taking seasonality, labour resources, work priority, skills and time required into account,
• to gradually and systematically remove weed species from the shores of Lake Ainsworth, encouraging increased biodiversity and improved habitat value,
• to strengthen and expand the existing vegetation through the planting of appropriate species in areas where natural regeneration is least likely to occur (i.e. highly disturbed, physically compacted and isolated areas),
• to increase public awareness of the importance of coastal vegetation and encourage local stewardship for the area, and
• to limit future re-infestation by weed species from adjoining areas.
2. SITE DESCRIPTION

2.1 Location
Lake Ainsworth is located at the northern extreme of the village of Lennox Head in Ballina Shire (northern New South Wales (NSW)) (Figure 1). The area addressed in this plan is defined by the lake, a picnic area, dune vegetation then the Coral Sea to the east, the northern end of the lake to the north, an unsealed road and area of extensive heathland to the west, and the Caravan Park to the south (Plates 1 and 2). The study area is approximately five hectares in size.

Figure 1. Location of Lake Ainsworth near Lennox Head. Source: AWACS, 1996.
Plate 1. Looking southwest across the lake from the air. This plan addresses management of the vegetation on the western side of the lake (photo: A.Erskine).

Plate 2. Looking southeast towards the lake from the Lake Ainsworth Sport and Recreation Centre. The unsealed road on the right forms the western boundary of the study area (photo: A.Erskine).
2.2 Geomorphology
Lake Ainsworth is a perched lake consisting of aquifer fed waters trapped above a layer of impervious coffee rock (indurated sand) (AWACS, 1996). The study area lies on an extensive coastal heath interrupted by ancient Pleistocene dunes and Melaleuca wetlands (Morand, 1994). This Pleistocene barrier is presumed to be of the last Interglacial Age (120,000 years old) (AWACS, 1996) and is made up of sands and clays deposited by marine and estuarine sedimentation. Groundwater immediately to the west of Lake Ainsworth flows away from the lake towards the Newrybar Swamp. It has been concluded that the groundwater divide around the lake coincides approximately with the boundary of the surface water catchment (AWACS, 1996).

2.3 Climate
Northeastern NSW experiences a temperate to subtropical climate due to its geographic location. Average rainfall fluctuates between 1600 and 1700 millimetres per year, with the highest falls in summer (November to April) (Anderson, 1999). Due to these seasonal rains and the consequent increase in ground water flows, the water level of Lake Ainsworth fluctuates greatly over any given year. Frosts are generally absent in the immediate coastal strip. The prevailing wind is from the southeast, however strong winds from the north are experienced in the spring and summer.

2.4 Land Tenure
Lake Ainsworth is Crown Land that is managed in trust by Ballina Shire Council and is zoned 7(f) (Environmental Protection – Coastal Lands) on Ballina Shire Council’s Local Environmental Plan. Hinddune areas to the north of the Sport and Recreation Centre are zoned 7(l) (Environmental Protection – Habitat).

2.5 Site History and Use
Prior to European settlement, members of the Bundjalung nation occupied several areas around the Richmond River. A well preserved Bora Ring is located in Gibbon Street in Lennox Head. This ceremonial site for the Aragwal people and the adjacent well established workshop areas, campsites and middens bear witness to long occupation and was declared an Aboriginal Place under the management of the National Parks and Wildlife Service (NPWS) in 1973 (RRHS, 1997). A survey carried out by Collins (1992) for a subdivision south of the lake revealed four open campsites containing stone artefacts.

Midden sites have also been recorded to the north and south of Seven Mile Beach on old remnant dunes behind the beach (Campbell, 1982) and small deposits of Turbinidae sp. shells have been uncovered near the existing four-wheel-drive beach access track by Dunecare workers. Jolande Nayutah from the Gungil Jindabah Centre at Southern Cross University (Lismore) has advised that Lake Ainsworth is the subject of a dreaming story relating to three Bundjalung brothers, which has been documented by NPWS officers (AWACS, 1996). The lake was also known to contain large eels and turtles in the past that would have supplemented other food resources such as the Pipi (Plebidonax deltoides) and seasonal mass gatherings of spawning mullet, tailor and salmon. If a midden or archaeological deposits are uncovered during restoration works, the location should be immediately reported to the NPWS before continuing further disturbance.
Lake Ainsworth is named after James Ainsworth who selected land nearby in 1867 to grow sugarcane (RRHS, 1997). The lake and surrounding lands were proclaimed a Crown Reserve in 1893 (RRHS, 1997). Lennox Head was isolated and surrounded by swamps and thick scrub until 1906, when a bridge was built across North Creek linking it to Ballina (RRHS, 1997). Besides a few pioneering farmers and fishermen, Lennox Head had few permanent inhabitants until 1922 when the first subdivision and consequent land sales boosted the population (RRHS, 1997). The lake was always popular (as now) for picnics and camping, and most of the eastern and southern portions of the lake were cleared of nearly all riparian and littoral vegetation to provide areas for recreation in the 1960s. A survey conducted during March and April 1996 (AWACS, 1996) estimated that on one Sunday 3100 people visited the lake, with up to 1600 being present at any one time.

3. SITE ASSESSMENT

3.1 Methods
Site inspections for this plan were conducted on the 10th and 17th of October 2001 and the 14th February 2002, with an aerial survey carried out on the 2nd of August 2001. Flora species were identified using a variety of guides, some of which are listed in section 7. Lists of the flora species encountered (natives and weeds) are included as Appendices 1 and 2.

Characteristics of the vegetation at Lake Ainsworth are described in this plan by identifying vegetation associations (Specht and Specht, 1999), i.e. the most common endemic species in the area and then the second most common e.g. Banksia integrifolia, Acacia sophorae association.

3.2 Vegetation
Vegetation communities on the western side of Lake Ainsworth are identified on Figure 2. Although the study area is relatively small, it displays a variety of ecological communities according mainly to differing heights above water level, exposure to salt laden winds, frequency of inundation, and fire sensitivity (Plate 3). The vegetation can generally be described as coastal sclerophyll (heath), dominated by Banksia spp. (Plate 4), with low-lying areas inhabited by Melaleuca wetland. It is predominantly a Melaleuca quinquenervia, Pellaea falcata association (Plate 5). Vegetation is quite healthy, although there is a lack of seedlings and juvenile specimens in some areas, and weeds are beginning to encroach on the site. The major weeds identified near Lake Ainsworth are described in Appendix 3.
Figure 2. Site map of the western side of Lake Ainsworth.
Plate 3. An area of frequent inundation on the western side of Lake Ainsworth (photo: A.Erskine).

Soils are low in nutrients and in some cases waterlogged at the study site; consequently the vegetation has evolved to a state where fire plays an important role in nutrient recycling. The species present often have volatile foliage that encourages flammability and are equipped with mechanisms, such as epicormic buds and lignotubers, which allow them to recover after fire. Fire, as well as enriching the soil with ash, also plays an important role in the germination of many of the species present. The period since last burn, season, and fuel loads will influence the type of fire and its duration, which has important implications for the ability of species to regenerate as too long between fires or too frequent fires will result in loss of diversity. Infestations of weeds can also alter the way an area burns and affect the vegetation’s ability to recover after fire. It is, however, beyond the scope of this report to include a detailed prescription for fire and its management.
3.3 Management Problems

- Weeds are inexorably invading the site. Efforts have been made over the last four years to minimise serious infestation but exotic fruiting trees and plants are still present. Of most concern in this area is the Umbrella Tree (*Schefflera actinophylla*). This north Queensland native displays a particular propensity towards the soil type around Lake Ainsworth and birds feed on nearby landscape specimens providing a constant source of seed. A bush regeneration team removed over 20,000 of these plants from this site in 2000, and although the numbers of this species are substantially reduced, seedlings, juveniles and mature specimens were still present in February 2002. Follow-up treatment is required at least annually. Workers must be trained to determine this species from the native *Polyscias elegans* that appears very similar as a juvenile (Plate 6). Also of concern is *Gloriosa superba* (Glory Lily) (Plate 7). After fruiting, the vegetative features of the Glory Lily die back to an underground rhizome until it re-shoots and regrows the next season. Control of this species should therefore be undertaken in January and February when it is flowering and at its most conspicuous. Other weeds encountered on the site, such as the invasive Ground Asparagus (*Protasparagus aethiopicus*) (Plate 8), are likely to have been introduced through the illegal dumping of garden waste, which is quite prevalent in adjacent heathland.

![Plate 6. Umbrella Tree (*Schefflera actinophylla*) seedling (photo: A.Erskine).](image-url)

Plate 8. Ground Asparagus (*Protasparagus aethiopicus*) is beginning to become a problem in some areas (photo: A.Erskine).
• Perhaps due to past use, some sections of the study area appear to have little regenerative ability (Plate 9). There are very few seedlings or juvenile trees present under the mature canopy, which allows detrimental winds uninterrupted egress.

Plate 9. There is a lack of natural regeneration under the mature canopy in some areas (photo: A.Erskine).

• Current management agency policy does not allow for paid qualified workers to carry out remediation or maintenance on public lands, consequently at Lake Ainsworth the task to date has fallen upon the shoulders of a single dedicated volunteer (Lennox Head Dunecare) who has occasional help from Community Service workers. This effort is now augmented by assistance from Lennox Head Landcare, however this type of work attracts few young volunteers and the heavy or very exposed work conditions can become onerous to aging retirees. Consequently, volunteer burnout is prevalent in the Ballina Shire. Teams provided by EnviTE or Conservation Volunteers Australia have supplemented Dunecare efforts in the past but the long-term future of this assistance is subject to Government policy and funding.

• There is a lot of litter left around the lake, few bins and irregular garbage collection services.

• Some areas of vegetation are trampled and individuals removed or damaged through inappropriate human use.
4. RECOMMENDATIONS

4.1 Regeneration Works
While the principal members of Lennox Head Dunecare are few, several other groups are available to assist with maintenance and regeneration works. It is envisaged that the work recommended in this plan could be undertaken by a combination of Green Corps, Work for the Dole teams, Conservation Volunteers Australia, local schools, Council staff, Lennox Head Landcare, Lennox Head Dunecare and EnviTE bush regenerators. The tasks described in this report require differing degrees of expertise depending on the sensitivity of the area and the job to be performed (e.g. experienced personnel with good plant identification skills should carry out selective herbicide spraying).

Tasks described below are listed in their preferred order of accomplishment, based on the urgency to arrest the problem, follow-up requirements, access, seasonal considerations and effort required, and in order of their appearance along the walking track around the lake. Weeds encountered should be treated as per the methods described in Appendices 4 and 5. Suggested equipment is outlined in Appendix 6.

1. Mature, fruiting Umbrella Trees in the vicinity should be located and stem injected with Glyphosate. These trees are conspicuous when flowering in January and February through to April. To ensure all trees are detected, stand on the western road and look for specimens protruding from the native canopy. Then take a compass bearing before seeking them out. This species has been deliberately used in the landscape at the adjacent Caravan Park, therefore the managers should be consulted and these specimens removed. Other undesirable plants at the Caravan Park include *Eucalyptus torreliana* (Cadagi), which is potentially invasive.

2. At the start of the track there is a persistent colony of *Gloriosa superba* (Glory Lily). This species is resistant to herbicide and quite capable of spreading further into the heath. To effectively remove this plant, it is necessary to physically dig out the underground root system. Although this appears laborious, it can be achieved while the infestation is presently relatively small. Care should be taken in handling and disposing of these roots as they are highly poisonous and all plant parts can potentially re-shoot if left on the ground. Bag all plant refuse and place in wheelie bins for burial at the Council landfill. This work should be conducted in summer as Glory Lily dies back to the root system in winter and becomes inconspicuous.

3. A few metres further down the track a large patch of Lantana has been cleared and native seedlings have been tagged with pink flagging tape. This area is now being re-colonised by weeds that may prove harder to control then the Lantana that was originally present. It is imperative that follow-up be carried out after clearing areas in high light conditions, as the gap created here potentially fragments the start of track vegetation from the rest of the remnant. If seedlings present do not reclaim the area in the next season or two, it should be planted with suitable (i.e. refer to Appendix 1 for native species present), locally sourced (refer to plant selection guidelines in section 4.1.1) species.
4. Continuing down the track to where the lake widens, small outbreaks of Ground Asparagus (*Protasparagus aethiopicus*), Lantana (*Lantana camara*) and Bitou Bush (*Chrysanthemoideas monilifera* subsp. *rotundata*) are present, as are numerous Umbrella Tree seedlings. To control these species, a meticulous sweep of the area should be carried out and individuals removed as encountered using hand removal or cut, scrape and paint techniques (refer Appendix 4). Spraying is unnecessary at this stage and could inadvertently effect subterranean orchids occurring in the area. Umbrella seedlings should be bagged and removed from the site, as they are capable of continued growth if uprooted and left in-situ.

5. Few weeds are encountered amongst the thick *Banksia aemula* colonies further along the track or in the very wet areas dominated by Melaleuca and Gahnia. However there are a few mature Umbrella Trees at the northern end of the lake and some isolated outbreaks of Bitou Bush. The large Umbrellas should be stem injected with Glyphosate and the Bitou cut, scraped and painted with Glyphosate (refer Appendix 4).

6. The floating water weed *Salvinia molesta* (Plate 10) is present on the northwestern edge of the lake, but appears to be adequately kept in check by its biological control agent the Cyrtabagous weevil. Efforts to manually control this weed, by raking it from the water to dry out on banks, have had some success in the past as the infestation appears less than it was three years ago. Also in this vicinity is the exotic water plant *Ludwigia peploides*. This plant is considered naturalised in northern NSW and may, in this situation, be offering security for native fish from the voracious appetites of the noxious Mosquito Fish that inhabit the lake. Removal of Ludwigia has been carried out on the eastern side of the lake by a Green Corps team and Lennox Head Dunecare, mainly due to it becoming a hazard to navigation. Removal was accomplished by uprooting the weed in the lake and pulling it ashore with rakes. No treatment is recommended for these weeds at present, however the extent of infestation should continue to be monitored, and treatment instigated if problems become obvious.
Plate 10. *Salvinia molesta* (brown) on the northwestern edge of the lake. Although it appears dead it will revive when inundated (photo: A.Erskine).

4.1.1 Plant Selection Guidelines
Care should be taken when replanting natural areas to use appropriate species that have been grown from seed collected nearby (refer to the plant propagation publications in section 7). Many species, such as *Banksia integrifolia*, have a very broad geographic range but genetic differences are found across this range. Trees found on the site have adapted to the specific conditions that occur around Lake Ainsworth.

The introduction of species that would not naturally occur on this site is not recommended. This can be detrimental to the ecological functions of the vegetation community. If the aims of the restoration project are to facilitate the establishment of typical pre-existing vegetation, then planting trees that do not belong will detract from achievement of this aim.
4.2 General Management Recommendations

- Training for Council Parks and Gardens staff in best practise environmental weed control and techniques for stimulating natural regeneration.
- Implementation of Council bush regeneration program whereby qualified bush regenerators are employed/contracted to conduct follow-up maintenance on environmentally significant sites, including around Lake Ainsworth, throughout the Shire.
- Lennox Head Landcare and Lennox Head Dunecare should continue to apply for assistance from EnviTE Work for the Dole teams and Conservation Volunteers Australia Green Corps, Green Reserve and/or volunteer teams. However care should be taken to allocate tasks to these groups that are appropriate to participants’ level of skill. Also, only the amount of work that can be adequately maintained should be attempted by teams to avoid the problem of reinfestation of areas, cleared but not followed up, by weeds that are potentially more problematic than those already there.
- Ballina Shire Council to install bins close to the walking track and frequently empty.
- Maintain existing track (Plate 11) and install educational signage at its entrance regarding the environmental values of the vegetation, restoration work undertaken in the area and its appropriate use.

Plate 11. The existing track through the vegetation on the western side of Lake Ainsworth (photo: A.Erskine).
4.3 Other Issues

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

Water
Plantings should be done during the wet season or use water crystals to prevent water loss.

Community Education
Regeneration workers can provide important community education by their visible efforts and achievements as well as explanation of work in progress. Interpretive signage can also assist in providing community education.

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

4.4 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 to 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 (i.e. three to six monthly) and after major events, such as big plantings, storms or fires. Records of working bees, including attendance, activities undertaken, weather constraints, successes and failures etc. are also invaluable monitoring tools. An example of a work record sheet is included as Appendix 7.
Another important aspect of monitoring is maintaining species lists. The native and weed lists in this plan (Appendices 1 and 2) should be continually updated as new species are encountered. It is also useful to establish a fauna species list for the site. This information, where relevant, should be shared with land managers such as Ballina Shire Council, the Department of Land and Water Conservation and the NPWS.

5. CONCLUSION

The vegetation on the western side of Lake Ainsworth is reasonably pristine and unaffected by many of the serious environmental weeds affecting other coastal areas in Ballina Shire. A minimum of restoration activity is required to ensure the long term conservation and enhancement of the area. There are many good reasons for doing this work including conservation of individual species and forest type, improved habitat for wildlife, and general public amenity. Environmental restoration can be very satisfying and the community/team interaction is renowned for forming long, trusting associations between individuals.
6. REFERENCES


7. RECOMMENDED READING

Management


Bush Regeneration and Weed Control


Plant Identification


**Plant Propagation**

## APPENDIX 1: Native Plant Species List

### Trees and Shrubs

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<tr>
<th>Family</th>
<th>Scientific Name</th>
<th>Common Name</th>
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<td>Arecales</td>
<td>Archontophoenix cunninghamiana</td>
<td>Bangalow Palm</td>
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<td>Coastal Cypress</td>
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</tr>
<tr>
<td>Solanaceae</td>
<td>Duboisia myoperoides</td>
<td>Corkwood</td>
</tr>
<tr>
<td>Thymeleaceae</td>
<td>Wikstroemia indica</td>
<td>Wikstroemia</td>
</tr>
<tr>
<td>Thymeleaceae</td>
<td>Pimelea linifolia subsp. linifolia</td>
<td>Rice Flower</td>
</tr>
</tbody>
</table>
### Climbing Plants

<table>
<thead>
<tr>
<th>Family</th>
<th>Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apocynaceae</td>
<td><em>Parsonsia straminea</em></td>
<td>Common Silkpod</td>
</tr>
<tr>
<td>Asclepiadaceae</td>
<td><em>Marsdenia rostrata</em></td>
<td>Common Milk Vine</td>
</tr>
<tr>
<td>Bignoniaceae</td>
<td><em>Pandorea pandorana</em></td>
<td>Wonga Wonga Vine</td>
</tr>
<tr>
<td>Dilleniaceae</td>
<td><em>Hibbertia scandens</em></td>
<td>Climbing Guinea Flower</td>
</tr>
<tr>
<td>Fabaceae</td>
<td><em>Kennedia rubicunda</em></td>
<td>Red Kennedy Pea</td>
</tr>
<tr>
<td>Lauraceae</td>
<td><em>Cassvyla sp.</em></td>
<td>Devils Twine</td>
</tr>
<tr>
<td>Loranthaceae</td>
<td><em>Dendrophthoe vitellina</em></td>
<td>Orange Mistletoe</td>
</tr>
<tr>
<td>Luzuriagaceae</td>
<td><em>Geitonoplesium cymosum</em></td>
<td>Scrambling Lily</td>
</tr>
<tr>
<td>Smilaceae</td>
<td><em>Smilax australis</em></td>
<td>Sarsaparilla</td>
</tr>
</tbody>
</table>

### Groundcovers, Grasses and Ferns

<table>
<thead>
<tr>
<th>Family</th>
<th>Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adiantaceae</td>
<td><em>Adiantum hispidulum</em></td>
<td>Rough Maidenhair</td>
</tr>
<tr>
<td>Campanulaceae</td>
<td><em>Wahlenbergia sp.</em></td>
<td>Australian Bluebells</td>
</tr>
<tr>
<td>Commeliniaceae</td>
<td><em>Commelina cyanea</em></td>
<td>Native Wandering Jew</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td><em>Gahnia aspera</em></td>
<td></td>
</tr>
<tr>
<td>Cyperaceae</td>
<td><em>Gahnia clarkei</em></td>
<td></td>
</tr>
<tr>
<td>Cyperaceae</td>
<td><em>Isolepis nodosa</em></td>
<td>Knobby Club Rush</td>
</tr>
<tr>
<td>Lomandraceae</td>
<td><em>Lomandra longifolia</em></td>
<td>Spiny-headed Mat Rush</td>
</tr>
<tr>
<td>Orchidaceae</td>
<td><em>Chiloglottis fornicatus</em></td>
<td>Pixie Caps</td>
</tr>
<tr>
<td>Orchidaceae</td>
<td><em>Geodorum densiflorum</em></td>
<td>Shepherds Crook Orchid</td>
</tr>
<tr>
<td>Orchidaceae</td>
<td><em>Pterostylis acuminata</em></td>
<td>Pointed Greenhood</td>
</tr>
<tr>
<td>Orchidaceae</td>
<td><em>Pterostylis ophioglossa</em></td>
<td>Snake Tongue Greenhood</td>
</tr>
<tr>
<td>Phormiaceae</td>
<td><em>Dianella revoluta</em></td>
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<tr>
<td>Poaceae</td>
<td><em>Themeda triandra</em></td>
<td>Kangaroo Grass</td>
</tr>
<tr>
<td>Sinopteridaceae</td>
<td><em>Pellaea falcata</em></td>
<td>Sickle Fern</td>
</tr>
<tr>
<td>Xanthorrhoeaceae</td>
<td><em>Xanthorrhoea johnsonii</em></td>
<td></td>
</tr>
<tr>
<td>Xanthorrhoeaceae</td>
<td><em>Xanthorrhoea macronema</em></td>
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### Aquatic Plants

<table>
<thead>
<tr>
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<th>Name</th>
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<tr>
<td>Azollaceae</td>
<td><em>Azolla filiculoides</em></td>
<td>Pacific Azolla</td>
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<tr>
<td>Droseraceae</td>
<td><em>Drosera spathulata</em></td>
<td>Common Sundew</td>
</tr>
<tr>
<td>Menyanthaceae</td>
<td><em>Nymphoides indica</em></td>
<td>Water Snowflake</td>
</tr>
<tr>
<td>Nymphaeaceae</td>
<td><em>Nymphaea sp.</em></td>
<td>Water Lily</td>
</tr>
<tr>
<td>Philydaceae</td>
<td><em>Philydrum lanuginosum</em></td>
<td>Hairy Frogmouth</td>
</tr>
<tr>
<td>Polygonaceae</td>
<td><em>Persicaria lapathifolia</em></td>
<td>Knot Weed</td>
</tr>
<tr>
<td>Typhaceae</td>
<td><em>Typha orientalis</em></td>
<td>Cumbungi</td>
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### APPENDIX 2: Weed Species List

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<thead>
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<th>Name</th>
<th>Common Name</th>
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<tbody>
<tr>
<td>Aracaceae</td>
<td>Syagrus romanzoffianum</td>
<td>Cocos Palm</td>
</tr>
<tr>
<td>Araliaceae</td>
<td>Schefflera actinophylla</td>
<td>Umbrella Tree</td>
</tr>
<tr>
<td>Asparagaceae</td>
<td>Protasparagus aethiopicus</td>
<td>Ground Asparagus</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Chrsanthemoides monilifera subsp. rotundata</td>
<td>Bitou Bush</td>
</tr>
<tr>
<td>Colchicaceae</td>
<td>Gloriosa superba</td>
<td>Glory Lily</td>
</tr>
<tr>
<td>Fabaceae</td>
<td>Senna pendula var. glabrata</td>
<td>Winter Senna</td>
</tr>
<tr>
<td>Fabaceae</td>
<td>Macroptilium atropurpureum</td>
<td>Siratro</td>
</tr>
<tr>
<td>Ochnaceae</td>
<td>Ochna serrulata</td>
<td>Mickey Mouse Bush</td>
</tr>
<tr>
<td>Onagraceae</td>
<td>Ludwigia peploides subsp. montevidensis</td>
<td>Water Primrose</td>
</tr>
<tr>
<td>Salvinidaceae</td>
<td>Salvinia molesta</td>
<td></td>
</tr>
<tr>
<td>Verbenaceae</td>
<td>Lantana camara</td>
<td>Lantana</td>
</tr>
</tbody>
</table>
APPENDIX 3: Weed Profiles

**TREES AND SHRUBS**

*Araliaceae*

*Schefflera actinophylla*

*Umbrella Tree*

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

*Arecaceae*

*Syagrus romanzoffianum*

*Cocos Palm*

Native of Brazil. A tall palm growing to twelve metres. Birds, rodents and water disperse its fleshy fruit. Fruit is also eaten and dispersed by flying foxes (Eby and Palmer, 1988, p.53). It is becoming a serious pest in northern NSW.

*Asteraceae*

*Chrysanthemoides monilifera subsp. rotundata*

*Bitou Bush*

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

*Fabaceae*

*Senna pendula var. glabrata*

*Winter Senna*

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

*Ochnaceae*

*Ochna serrulata*

*Mickey Mouse Bush*

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

*Verbenaceae*

*Lantana camara*

*Lantana*

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

**Asparagaceae**

*Protasparagus aethiopicus*

**Ground Asparagus**

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

**Colchicaceae**

*Gloriosa superba*

**Glory Lily**


**Fabaceae**

*Macroptilium atropurpureum*

**Siratro**

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

**AQUATIC PLANTS**

**Onagraceae**

*Ludwigia peploides subsp. montevidensis*

**Water Primrose**

Prostrate often villous herb, rooting at the nodes or floating, with pneumataphores restricted to submerged parts, flowering stems ascending. Leaves alternate, oblanceolate to ovate, usually one to ten centimetres long. Flowers yellow, darker at the base. Flowers in summer and autumn. Grows on margins of lakes and along streams (Harden, 1991, p. 202).

**Salviniaceae**

*Salvinia molesta*

Aquatic fern, free floating, 5 to 20 centimetres long. Fronds in whorls of three, the two floating fronds strongly keeled. Leaves circular to ovate with a chordate base, one to four centimetres long. The upper surface of the leaf is covered with long papillae and the lower surface bears densely matted brown hairs. Introduced from South America (Harden, 1990, p. 71).

References:


APPENDIX 4: Weed Treatment Methods

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

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

2. “Gouge-paint”: this method applies to those plant species that have a fleshy root system,
   such as rhizomes or large bulbs. It is particularly appropriate for the treatment of
   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.

# APPENDIX 5: Treatment Methods for the Weeds at Lake Ainsworth

## Trees and Shrubs

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Control Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Chrysanthemoides monilfera subsp. rotundata</em></td>
<td>Bitou Bush</td>
<td>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.</td>
</tr>
<tr>
<td><em>Schefflera actinophylla</em></td>
<td>Umbrella Tree</td>
<td>Hand pull seedlings and bag. Cut-scrape-paint or stem inject 1:1.5. Cut sections can regrow if left on ground.</td>
</tr>
<tr>
<td><em>Senna pendula var. glabrata</em></td>
<td>Winter Senna</td>
<td>Hand pull young plants or spray seedlings 1:50 + LI700®. Cut-scrape-paint 1:1.5. Stem inject large specimens 1:1.5. Bag seeds.</td>
</tr>
<tr>
<td><em>Syagrus romanzoffianum</em></td>
<td>Cocos Palm</td>
<td>Hand pull or crown seedlings, cut larger plants below growing point, spray resistant.</td>
</tr>
<tr>
<td><em>Ochna serrulata</em></td>
<td>Mickey Mouse Bush</td>
<td>Cut-scrape-paint 1:1.5. Spray seedlings 1:50 + LI700®, difficult to hand pull, will regrow from broken root.</td>
</tr>
</tbody>
</table>

## Vines and Scramblers

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Control Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acetosa sagittata</em></td>
<td>Turkey Rhubarb</td>
<td>Hand remove plant and tuber. Bag tubers.</td>
</tr>
<tr>
<td><em>Gloriosa superba</em></td>
<td>Glory Lily</td>
<td>Hand remove plant and tuber. Bag tubers (highly poisonous). Treat in December and January when flowering.</td>
</tr>
<tr>
<td><em>Protasparagus aethiopicus</em></td>
<td>Ground Asparagus</td>
<td>Hand remove (crowning of rhizome). Spray Metsulfuron 1.5g/10L and Agral® 20mL/10L.</td>
</tr>
</tbody>
</table>

## Aquatic Plants

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Control Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ludwigia peploides subsp. montevidensis</em></td>
<td>Water Primrose</td>
<td>Do not treat. Hand remove if becomes a problem.</td>
</tr>
<tr>
<td><em>Salvinia molesta</em></td>
<td></td>
<td>Do not treat. Hand remove if becomes a problem.</td>
</tr>
</tbody>
</table>

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 6: 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 7: Regeneration Record Sheet

### REGENERATION RECORD SHEET

<table>
<thead>
<tr>
<th>Remnant Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel/Volunteers:</td>
<td>Hours Worked:</td>
</tr>
<tr>
<td>Weather Conditions (temperature, prevailing wind, cloud cover etc.):</td>
<td></td>
</tr>
<tr>
<td>Work Completed (work zone – use map on reverse, methods trialed, comments on previous works, monitoring, follow-up or reminders etc.):</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weeds Treated</th>
<th>Methods Used</th>
<th>Chemical &amp; Application Rate</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Chemical</th>
<th>Vol. Used (ml)</th>
<th>Chemical</th>
<th>Vol. Used (ml)</th>
</tr>
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<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Payment/Funding</th>
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<th>Invoice No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations (flora, fauna, fruiting, flowering etc.):

Accidents/Incidents/Near Misses: