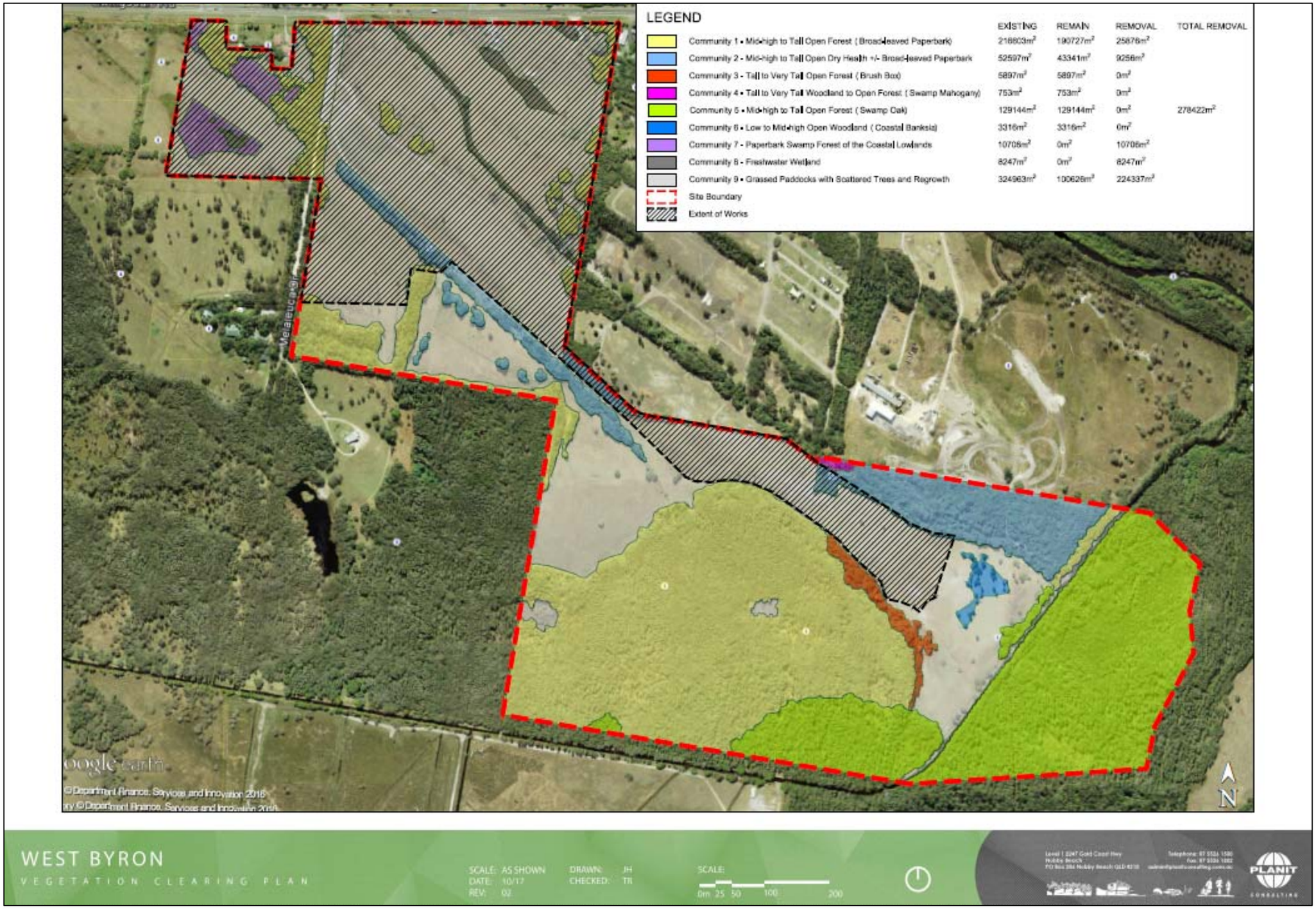


FIGURE 6: VEGETATION CLEARING PLAN

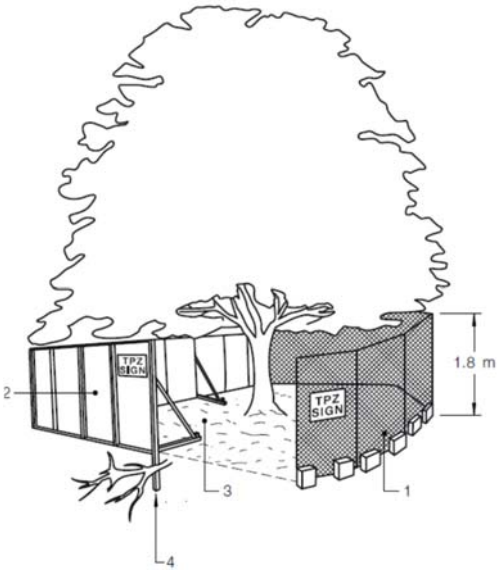
Management of Trees During Clearing

Retained native vegetation (individual trees and copses of vegetation) proximate to earthworks which are not subject for removal are to be clearly fenced and managed during construction activities (refer to Figure 7 below) in accordance with the Australian Standard 'AS 4970 Protection of Trees on Development Sites' to avoid any of the following:

Within the retention zone tree management is to occur as follows:

- Retained native vegetation (trees and copses of vegetation) proximate to earthworks are to be clearly fenced and managed during construction activities and through the establishment and maintenance periods in accordance with the Vegetation Management Plan and Australian Standard AS 4970 Protection of trees on development sites to avoid any of the following:

Structural damage to the tree including root damage;
- o Compaction of the root plate including parking of any vehicles;
- o Filling of soil within the tree protection zone (tpz) and/or drip zone; and
- o Storage of any building materials within the drip zone;
- o Long-term harm to the health of the tree.



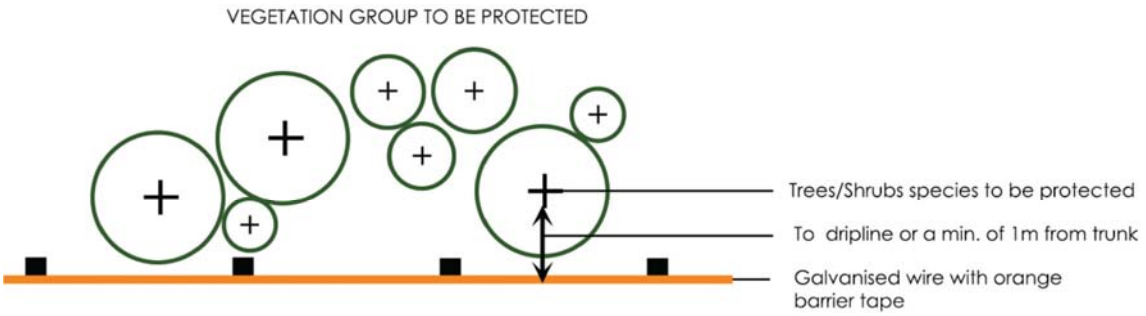
LEGEND:

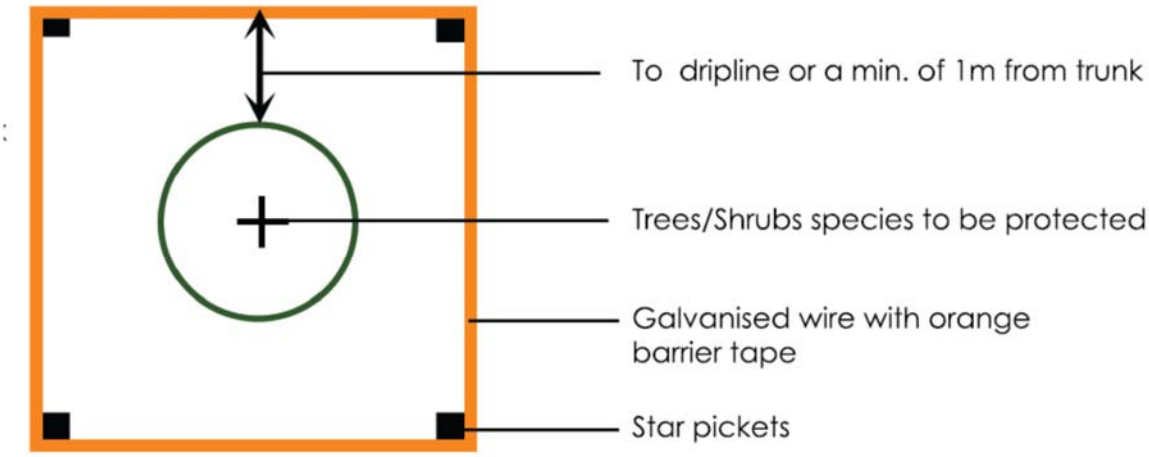
1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.

2 Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the Tree Protection Zone (TPZ).

3 Mulch installation across surface of TPZ (at the discretion of the superintendent). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.

4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.





INDIVIDUAL TREE TO BE PROTECTED

FIGURE 7: EXAMPLES OF VEGETATION PROTECTION FENCING

A detailed Vegetation Management Plan for the construction and vegetation clearing and construction phases of the proposal (refer to Attachment 2).

2.7 EXISTING FAUNA

The fauna survey of the site (and immediately adjacent areas) conducted by Planit resulted in the recording of eighty-five (85) species of birds, twenty-five (25) species of mammals, nine (9) species of reptiles and thirteen (13) species of amphibians (or evidence of their presence).

Of these species, eight (Wallum Froglet, Wallum Sedgefrog, Koala, Grey-headed Flying-fox, Little Bent-wing Bat, Eastern Bent-wing Bat, Greater Broad-nosed Bat and Southern Myotis) are listed as vulnerable within the *Threatened Species Conservation Act 1995*. Three of these (Koala, Wallum Sedgefrog and Grey-headed Flying Fox) are also listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1995*.

3.0 SITE REHABILITATION

Rehabilitation of the site is proposed to compensate for the unavoidable residual impacts associated with the proposed development and to rehabilitate selected areas within the site to consolidate and enhance the existing flora and fauna corridors which is currently fragmented in areas.

REHABILITATION PROCESS

A long-term staged rehabilitation/revegetation process has been derived for the 10ha subject areas. This strategy shall chronologically focus upon assisting natural regeneration, plantings of pioneer species (to establish cover and suppress pasture weeds) and increasing floristic diversity. Additional actions to exclude cattle and increase foraging potential for threatened fauna shall also be performed.

REHABILITATION SPECIES

A wide range of native species endemic to the area will be selected for the rehabilitation areas. In this regard, Rehabilitation Areas/Zones 1A and 1B will be rehabilitated (combination of 'assisted natural regeneration' and revegetation/landscaping) with Freshwater Wetland species with Swamp Sclerophyll species within the tree layer. This will provide acidic frog habitat, as well as habitat for numerous other locally occurring fauna species (as discussed within Section 5).

Rehabilitation Area/Zone 2 will be rehabilitated Swamp Sclerophyll Forest species which will contain preferred koala feed trees (i.e. E. robusta and E. tereticornis), as well a potential foraging material for other locally occurring threatened fauna (i.e. flying-foxes).

The rehabilitation program over the 10 hectares will be staged over the project delivery timeframe which includes monitoring and maintenance and ultimately managed by the lot owner in accordance with the Voluntary Planning Agreement dated October 2014.

4.0 REHABILITATION STRATEGY

This Section outlines the Rehabilitation/Revegetation Strategy for the Environmental Protection Zones (EPZs) which will include the following:

- EXISTING VEGETATION COMMUNITIES: Existing vegetation communities located external to the works area and within Zoned E2 and E3 areas of WBURA (refer Figure 2). The predominate management strategy for these zones will be exclusion of cattle, monitoring and control of environmental weed infestations (to promote ongoing natural regeneration)

- REHABILITATION ZONES: The 10ha rehabilitation zone (Zones 1A, 1B and 2, refer to Figures 8, 11 and 14). A detailed staged rehabilitation/revegetation strategy for these zones is contained within the following sections of this report and focus upon removing threatening impacts (i.e. weed invasion), managing natural regeneration and revegetation works to deliver the proposed vegetation communities. Targeted fauna habitat enhancement works are also proposed.

In accordance with best management practice restoration and rehabilitation works should seek to stabilize and reverse the negative effects of habitat fragmentation. That is, priority should be given to works which protect and expand larger remnants so that they are reintegrated into larger revegetated areas. This is based on the following ecological observations:

- Habitat fragmentation generally reduces the viability of both faunal and floral populations by restricting ranges of fauna below minimum levels and by preventing the natural exchange of genetic material which may ensure genetic vigour.

- Reconnecting fragmented landscapes into larger, (and, where appropriate, more consolidated) units by filling in gaps can increase habitat area and may improve linkages for passage of species. (The configuration of those linkages, however, will determine whether edge/area ratios reduce or increase.)

- Narrow corridor links may themselves be subject to feral predation, disease and species imbalances, therefore, the width of a corridor should exceed the extent of edge effects.

- Biological potential for diverse natural regeneration and expansion frequently exists in and adjacent to remnants. Investments which harness this potential usually provide higher ecological returns than reconstruction elsewhere (Greening Australia, 1999).

As such, the 10 hectares of site rehabilitation/restoration have been sited to close remnant canopy caps, re-connect existing fragmented remnants, increase the area:edge ratio of ecological community remnants and increase existing fauna habitat corridor widths and providing additional habitat and forage material for fauna species.

The below rehabilitation strategy is recommended and aimed initially at the protection of habitats to be retained within the Environmental Protection Zones (EPZs) and secondly at providing a level of enhancement (where required).

It often takes a period of several years before the achievement of such aims are realised and as such it is of paramount importance that an appropriate strategy is derived and implemented in the initial phases of rehabilitation.

The primary objectives recommended for the EPZ are quite simple and include:

- Retain significant existing communities (refer Figure 6)
- Retain and enhance existing fauna habitat
- Remove and manage processes potentially threatening the viability of existing remnants
- Increase the extent of vegetation communities and potential fauna habitat over time

Two management techniques will be implemented for the EPZs as follows:

EPZ	OVER-RIDING TECHNIQUE
Existing vegetation communities	Weed removal and ongoing monitoring only (no revegetation)
Rehabilitation Zones	Assisted Natural Regeneration

Weed removal and management is discussed within Section 4.1 below and will be undertaken where necessary within the existing vegetation communities in association with routine management.

The 10ha rehabilitation zone will be managed via Assisted Natural Regeneration (Greening Australia (1999)) due to its location within a fragmented landscape and proximity to established native vegetation communities. Greening Australia (1999) notes that 'in or immediately adjacent to remnants, priority is given to facilitation of natural regeneration. In these locations, planting or direct seeding is only carried out where pre-existing species are incapable of colonization – and after a "rest" period sufficient to test natural regeneration. This is based on the following ecological and field observations.

- Natural regeneration potential can be surprisingly persistent in and adjacent to fragmented remnants.

- Natural regeneration maintains natural selection processes, can provide a wider range of site adapted species and genetic stock, demonstrates any capacity for future regeneration, and informs us about a site's regeneration dynamics and any pre-existing species requiring reintroduction.

- Planting can interfere with regeneration and compromise the genetic integrity and scientific value of a site. Planted stock may not regenerate if the species selection or genetic stock is inappropriate to the site.

- The mechanisms of recovery of individual species after natural disturbances (particularly whether they form persistent soil seed banks or not) can provide insight into the restoration approach needed. This determination can be improved by conducting preliminary trials to trigger germination from soil seed banks (e.g. using fire, smoke, tillage or irrigation as appropriate) - Such trials can also help to determine pre-existing plant associations more precisely.'

A staged strategy (refer Section 4.0/4.2) which involves a combination of monitoring (and promoting through cattle exclusion and weed management) natural regeneration for a minimum period of 12 months, planting pioneer species (if needed) and supplementary planting (groundcovers and diversity plantings-if needed) has therefore been established. This approach will ensure that establishment of endemic genetic flora is maximized over the life of the rehabilitation project.

Assisted Natural Regeneration (with follow up planting only where necessary) applies:

- To natural areas where the native plant community is largely healthy and functioning.
- When native plant seed is still stored in the soil or will be able to reach the site from nearby natural areas, by birds or other animals, wind or water.
- Where the natural regeneration processes (seedling germination, rootsuckering, *etc*.) are being inhibited by external factors, such as weed invasion, soil compaction, cattle grazing, mechanical slashing, etc
- When limited human intervention, such as weed removal, minor amelioration of soil conditions, erection of fencing, cessation of slashing, etc. will be enough to trigger the recovery processes through natural regeneration.
- When the major component is weed control.

As discussed above assisted natural regeneration will apply to the 10ha regeneration/restoration zones.

Where assisted natural regeneration does not meet the minimum plant density (refer to Section 4.5 below), reconstruction/landscaping will be required within these areas.

Large-scale Planting (Reconstruction) applies:

- Where the site is highly degraded or altered and natural assisted regeneration does not meet the minimum plant density as described within Section 4.5.

4.1 WEED MANAGEMENT STRATEGY

The following weed management strategy has been prepared for the EPZ. The intent of the strategy is to progressively remove weed species from these areas. Substantial research regarding weed management activities within areas of native bushland has been undertaken in this regard. The strategy presented has been adapted from the following sources:

- Bradley, J. (1988) *Bringing back the bush: The Bradley method of bush regeneration.* Lansdowne Publishing Pty. Ltd. The Rocks, NSW;
- Buchanan, R. A. (1989) *Bush Regeneration: Recovering Australian Landscapes*. TAFE Student Learning Publications, NSW;
- Robertson, M. (1994) *Stop Bushland Weeds: A guide to successful weeding in South Australia's bushland*. The Nature Conservation Society of South Australia Inc;
- Greening Australia (1995) *Local Greening Plans: A Guide for Vegetation and Biodiversity Management*. Greening Australia, Canberra;
- Department of Planning (1991) *Urban Bushland*. Department of Planning, Sydney.
- Department of Environment and Heritage (1999) *Suggested Conservation Criteria for Development Assessment for use by Local Government Officers*. DEH, Brisbane.
- Kanowski, J., Catterall, C. P., Freebody, K. and Harrison, D. A. (2008) *Monitoring Revegetation Projects for Biodiversity in Rainforest Landscapes. Toolkit Version 2*.

Report to the Marine and Tropical Sciences Research Facility. Reef and Rainforest Research Centre Limited, Cairns.

1. Target areas of least disturbance and weed invasion and work towards the more weed infested areas.

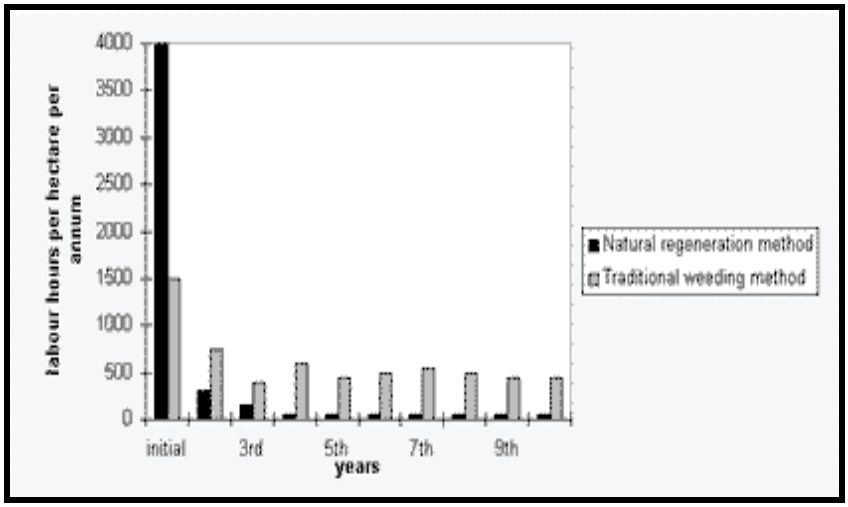
Under these circumstances the indigenous species have the upper hand because their seed or spores are already in the ground and the natural environment favours the plants that have evolved in it (Bradley 1988). This method represents a significant reduction in follow-up time and related costs because the regeneration is more likely to comprise a higher proportion of native species. It is noted that this method is the EPAs preferred method of weed control (DEH, 1999).

2. Minimising the amount of soil disturbance will reduce the potential for a fresh weed invasion.

Weeding will cause some disturbance to the existing soil structure and layers depending on weed methods utilised (i.e. mechanical removal, hand removal). Disturbed soil should therefore always be returned as close as possible to its original layer and firmed down. This includes the mulch which is the first line of defence against a fresh invasion (Bradley 1988).

3. Let native plant regeneration dictate the rate of weed removal

The regeneration of native species is inversely proportional to increasing weed growth. Therefore, weeding should not automatically move into more degraded areas when less infested areas have been initially weeded. It is often better to simply wait for the less infested areas to regenerate before proceeding slowly into the worse areas. Clearing all infested areas at once causes extensive, additional follow up weeding works (refer below figure).



Source - Ku-ring-gai Parks Dept. NSW, cited in Buchanan (1989) Comparison of labour hours using traditional weeding and natural regeneration methods.

Implementing these principles into a weed management strategy should begin by determining priority species and areas for management. In this regard inspections of the EPZs note the following with regard to weed presence:

EPZ	OBSERVED WEED PRESENCE
Existing Vegetation Communities	The existing native vegetation communities (refer Figure 5) contain minor elements of weed invasion, mostly on the perimeters or edges. Those recorded are described below: <u>Community 1 – Mid-high to Tall Open Forest (Broad-leaved Paperbark)</u> Weed were generally scarce within this vegetation community and primarily occupied along the fringes which are subject to historical slashing and grazing. Species noted included pasture/exotic grasses (*Axonopus fissifolius*, *Paspalum dilatatum*, *Pennisetum clandestinum*, *Setaria sphacelata, Stenotaphrum secundatum*), Crofton Weed, Blue Billygoat Weed, Coral Berry, Thickhead, Umbrella Tree, Broad-leaved Pepper Tree, Easter Cassia, Paddy's Lucerne, Camphor Laurel, Wild Tobacco and Cocos Palm. <u>Community 2 – Mid-high to Tall Open Dry Heath +/- Broad-leaved Paperbark</u> Weed species were generally scarce within this community and primarily occupied the fringes of this community. Species noted include Ground Asparagus Bitou Bush, Flaxleaf Fleabane, Lantana, Slash Pine, Umbrella Tree and Fireweed. Exotic/pasture grasses were also noted. <u>Community 3 – Tall to Very Tall Open Forest (Brush Box)</u> Species occurring within this community were common tree/shrub species such as coral berry, camphor laurel, umbrella tree and easter cassia with exotic/pasture grasses along the northern fringe. <u>Community 4 – Tall to Very Tall Woodland to Open Forest (Swamp Mahogany)</u> Weed species within this small forest patch included Umbrella Tree with lesser occurring Camphor Laurel, Broad-leaf Pepper Tree, Easter Cassia, Wild Tobacco, Blackberry Nightshade and Cocos Palm. Coastal Morning Glory was also observed covering several native trees. <u>Community 5 – Mid-high to Tall Open Forest (Swamp Oak)</u> Weed species were common within areas proximate to Belongil Creek which included pasture/exotic grasses and species such as Lantana, Groundsel Bush, Bitou Bush, Flaxleaf Fleabane, Umbrella Tree, Broad-leaf Pepper Bush, Camphor Laurel, Easter Cassia, Wild Tobacco and Blackberry Nightshade. <u>Community 6 – Low to Mid-high Open Woodland (Coastal Banksia)</u> Weed species within this community were dominated by pasture/exotic grasses with the occasional wild tobacco and umbrella tree noted.
Rehabilitation Zones	Rehabilitation Zones (zones 1A, 1B and 2) are occupied by pasture grasses and herbaceous pasture weeds (i.e. blue billygoat weed, cobbler's pegs, wild tobacco, flaxleaf fleabane, purpletop, balloon cottonbush etc.) and the occasional Slash Pine and Camphor Laurel tree. Additional weeds noted within and within proximity to the rehabilitation zone are as described within Community 9 (refer Section 2.4 above).

Recommended treatment for recorded weed species listed in the table below have been sourced from Appendix 8 "Common Weeds of Northern NSW Rainforest – A Practical manual on their identification and control" produced by The Big Scrub Rainforest Landcare Group and Appendix 3 of the 'SEQLD Ecological Restoration Framework Manual.'

<u>Abbreviations used within Table below:</u>

CS&P = cut, scrape and paint
C&P = cut and paint
F/I = frill/stem-inject/spear or drill
S&P = scrape and paint

Numbers in brackets are:
G = glyphosate dilution ratios, MM = metsulfuron-methyl dilution ratios
S = surfactant, e.g. LI 700
W = wet-ting agent, e.g. Agral, Pulse
O = denotes use of spray adjuvant, e.g. Codacide, Protec Plus

Scientific Name	Common Name	Recommended Treatment
Ageratum houstonianum	Blue Billygoat Weed	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Plants: spot spray (G 100 mL/10 L + S or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Ageratina adenophora	Crofton Weed	Mechanical removal where located within designated earthworks and clearing zones. Treatment as below: Plants: spot spray (G 100 mL/10 L + S or O, or MM 1-2g/10L + W or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted. NOTE: No slashing of seeding crofton weed is to occur. If plant is seeding at any time during the management period, individual plants are sprayed as above or to be removed via hand (for recolonised and/or isolated plants) and bagged to prevent potential for seed spread via wind.
Asparagus aethiopicus	Asparagus Fern	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Initial treatment via hand removal using crowning technique and hanging off ground to dry. For successful weed control it is vital to cut out the entire central growing point. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted. Plants: spot spray (Glyphosate + Metsulfuron Methyl 200mm Gly + 1.5g MM in 10L water A/S + D).
Baccharis halimifolia	Groundsel	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Seedlings: hand-pull or CS&P (G1:15). Or spray (G200mL/10L + S or O). Trees: CS&P or F/I (G1:1). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted NOTE: If groundsel is seeding at any time, individual plants are to be removed via hand and bagged to prevent seed spread via wind.
Bidens pilosa	Cobblers Pegs	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Hand pull seedlings or spot spray 1:50 Glyphosate + Surfactant + Colour Marking Dye or for better results spray 1:50 Glyphosate + 1.5g Metsulfuron methyl:10L water + Spray adjuvant + Colour Marking Dye. Saplings CS&P Glyphosate1:1.5 + Colour Marking Dye. Trees stem inject 1: 1.5 Glyphosate + Colour

Scientific Name	Common Name	Recommended Treatment
		Marking Dye. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Cinnamomum camphora	Camphor Laurel	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Hand pull seedlings or spot spray 1:50 Glyphosate + Surfactant + Colour Marking Dye or for better results spray 1:50 Glyphosate + 1.5g Metsulfuron methyl: 10L water + Spray adjuvant + Colour Marking Dye. Saplings CS&P Glyphosate1:1.5 + Colour Marking Dye. Trees stem inject 1: 1.5 Glyphosate + Colour Marking Dye. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Crassocephalum Crepidioides	Thickhead	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] is to occur. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Cirsium spp.	Thistle	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] is to occur. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Crotalaria spp.	Rattlepod	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] or hand removal is recommended. Spot spraying is to ensure all foliage is wetted. Spot spraying of recolinised juveniles following 2-3 week period.
Gomphocarpus physocarpus	Cotton Bush	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] or hand removal is recommended. Spot spraying is to ensure all foliage is wetted. Spot spraying of recolinised juveniles following 2-3 week period.
Hypochaeris radicata	Flatweed	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] is to occur.

Scientific Name	Common Name	Recommended Treatment
		Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Ipomoea cairica	Coastal Morning Glory	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Vines: hand-pull or CS&P (1:1.5). Materials above head height to be left insitu where it will die and fall to the ground as natural mulch. Spot spray: (G 100 mL/10 L + S or O, or G 200 mL/10 L + MM 1.5 g/10 L + W or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Lantana camara	Lantana	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Lopper, then CS&P base 1:1.5 G Spot spray regrowth and overspray large infestations (G200mL/10L G + S or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Macroptilum atropurpureum	Siratro	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Vines: hand-pull or CS&P (1:1.5). Materials above head height to be left insitu where it will die and fall to the ground as natural mulch. Spot spray: (G 100 mL/10 L + S or O, or G 200 mL/10 L + MM 1.5 g/10 L + W or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Nephrolepis cordifolia	Fishbone Fern	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Hand removal or crown and hang to dry. Plants: spot spray (Glyphosate + Metsulfuron Methyl 200mm Gly + 1.5g MM in 10L water A/S + D). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Neonotonia wightii	White Glycine	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Vines: hand-pull or CS&P (1:1.5). Materials above head height to be left insitu where it will die and fall to the ground as natural mulch. Spot spray: (G 100 mL/10 L + S or O, or G 200 mL/10 L + MM 1.5 g/10 L + W or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.

Scientific Name	Common Name	Recommended Treatment
Ochna serrulata	Mickey Mouse Plant	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying (Glyphosate + Metsulfuron Methyl 200mm Gly + 1.5g MM in 10L water A/S + D). Spot spraying is to ensure all foliage is wetted Follow-up spot spraying following 2-3 week period Scrape (lightly) and paint (juvenille) – undiluted Gly
Pinus elliottii	Slash Pine	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Hand pull seedlings or spot spray (G200mL/10L + S or O). Saplings and trees: cut close to ground or ringbark or F/I (G1:1.5) ensuring bark is penetrated. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Schefflera actinophylla	Umbrella Tree	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Mature stems to be treated via Cut-stump method. This will involve cutting the trunk at ground level and immediately swabbing the stump surface with Roundup Biactive. Spot spraying of recolinised juveniles with Roundup Biactive [at a ratio of 1:100] following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Sida rhombifolia	Paddy's Lucerne	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Plants: spot spray (G 100 mL/10 L + S or O, or MM 1-2 g/10L + W or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Senna pendula var. glabrata	Easter Cassia	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Shrubs: CS&P (G1:1.5) Plants: hand-pull or spray (G 200 mL/10 L + S or O. Collect and bag seed pods. Follow-up spot spraying or hand removal of recolinised individuals following 2- 3 week period.
Senecio madagascariensis	Fireweed	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] is to occur. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.

Scientific Name	Common Name	Recommended Treatment
Solanum mauritianum	Wild Tobacco	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Cut-stump treatment is to occur for mature stems. This will involve cutting the trunk at ground level and immediately swabbing the stump surface with Roundup Biactive. Spot spraying of recolinised juveniles with Roundup Biactive [at a ratio of 1:100] following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Solanum nigrum	Blackberry Nightshade	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Small plants and those within the groundlayer to be removed via spot spraying with Roundup Biactive [at a ratio of 1:100] or hand removal. Spot spraying is to ensure all foliage is wetted. Smothering infestations within shrub/tree layer are to be treated via cut stump treatment. Materials above head height to be left insitu where it will die and fall to the ground as natural mulch
Sphagneticola trilobata	Singapore Daisy	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Plants: spot spray (G 200 mL/10 L + MM 1.5g/10L + W or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Syagrus romanzoffianum	Cocos Palm	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Seedlings: hand-pull or crown or spot spray (G 200 mL/l0 L + S or O, or G 200 mL/10 L + MM 1.5 mL/l0 L + W or O, or MM 1-2 g/10 L + W or O). Trees: cut below growing point or F/I (G 1:1.5). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted
Taraxacum officinale	Dandelion	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] is to occur. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Trifolium repens	White Clover	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying with Roundup Biactive [at a ratio of 1:100] is to occur. Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.

Scientific Name	Common Name	Recommended Treatment
Digitaria didactyla *Cynodon dactylon* *Andropogon virginicus* *Chloris gayana* *Eragrostis curvula* *Melinis minutifolia* *Melinis repens* *Megathyrsus maximus* *Paspalum spp.* *Pennisetum clandestinum* *Setaria spp.* *Sporobolus africanus*	Exotic/Pasture Grasses	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Spot spraying of clumps and hand removal of scattered individuals. Plants: spot spray (G 100 mL/10 L + S or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted.
Verbena bonariensis	Purpletop	Mechanical removal where located within designated earthworks and clearing zones. Elsewhere treatment as below: Plants: spot spray (G 100 mL/10 L + S or O). Follow-up spot spraying or hand removal of recolinised individuals following 2-3 week period. Spot spraying is to ensure all foliage is wetted. Given low leaf surface area of this species, if isolated plants occur (i.e. small numbers, not within an area dominated by other weeds) they are to be removed via hand.

Recommended Application Technique For Spraying (Knapsack/Handgun Equipment)

The dilution rate is given as a ratio of herbicide volume to water volume. Adjust equipment to achieve an even spray pattern. Apply to ensure complete and uniform wetting of all foliage. For handgun equipment, a D6 spray tip (Spraying Systems Australia P/L) or equivalent, and an operating pressure of 400-700 kPa are recommended.

Additional Recommendations: Surfactant

GENERAL GUIDELINES

Do not vary from the 200ml of Pulse per 100L of spray solution because as has been shown, this is the optimum rate for Pulse. Do not reduce the rates of Roundup as all trial work has shown that the recommended label rates of Roundup are needed to achieve control. AVOID EXCESSIVE AGITATION BOTH WHEN MIXING AND WHEN SPRAYING, AS FOAMING CAN OCCUR IF SOLUTION IS OVER AGITATED. Wear gloves and a face shield or goggles when handling Pulse undiluted as it is severely irritating to the eyes.

Mixing:

1. Half fill tank with water
2. Add the correct amount of Roundup and mix
3. Fill tank until almost full
4. Add Pulse at the rate of 200ml per 100ml of spray solution and mix
5. Complete filling tank.
6. Mix.

RESTRAINTS ON USE

Pulse should not be added to Roundup as a general-purpose surfactant as some antagonism can occur between Roundup and Pulse on typically easy-to-kill grasses such as wild oats and Brome grass. Currently there are no other herbicides recommended for use with Pulse on the Pulse label. Users should check with the manufacturer before using any particular herbicide or other pesticide with Pulse. Pulse I not a general-purpose surfactant but rather a specific spray additive for Roundup herbicide for the improved control of brush and woody weeds.

RECOMMENDED APPLICATION TECHNIQUE FOR CUT-STUMP TREATMENT

Cut stump treatment will involve cutting the stem of the plant at ground level and immediately swabbing the stump surface with Roundup Biactive (1 part roundup: 2 parts water).

RECOMMENDED APPLICATION TECHNIQUE FOR STEM INJECTION

This shall involve use of an applicator calibrated to deliver 1 or 2 mL of Roundup Biactive per cut. 5cm cuts at 10-15cm centres around the trees circumference are to be made at an oblique angle to ensure penetration of the sapwood beneath the outer bark.

Additional Recommendations

- All weed control must be undertaken by a suitably qualified Bush regenerator or Bushland Restorator.
- All environmental weeds (including garden/nursery escapees) must be controlled within the weed management areas
- Where areas are spot-sprayed and/or hand weeded, weed material must be left in-situ to act as natural site mulch.
- Spot-spraying must occur from areas that are dominated by native vegetation and extend into more weedy areas.
- Weed control (especially groundcover weed control) must be undertaken in a manner which does not promote erosion or instability of soil, especially in waterways or high velocity flow zones.

- Herbicide dye must be used to reduce the potential for over spraying or re-spraying of previously treated areas. If evidence of excessive spraying exists or if off target damage is evident, rehabilitation will be required to the satisfaction of Council to ensure all areas are stable and not at increased risk of erosion due to off target damage.
- All undesirable vine species must be treated by cutting the plant twice. Once at head height and then at ground level. Immediately after cutting at ground level herbicide must be applied using the cut, scrape and paint method.

Referenced Material:

Mann, M. (2000) *Toxicological Impact of Agricultural Surfactants on Australian Frogs* (PHD Thesis). Curtin University of Technology, Perth
Nufarm Australia Limited (undated) Roundup Biactive Herbicide by Monsanto NRA Approval No. 48518/1102
Big Scrub Rainforest Landcare Group (2005) *Subtropical Rainforest Restoration: A Practical Manual and Data Source for Landcare Groups, Land Managers and Rainforest Regenerators*. BSRLG, Bangalow.
Chenoweth EPLA and Bushland Restoration Services (2012) *South East Queensland Ecological Restoration Framework: Manual.* Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane

In association with the removal of the designated weed species from the regeneration zone, a revegetation/regeneration strategy should be selected to ensure that the newly weeded areas become established with native species. The regeneration strategies to be utilised on site are discussed below:

4.2 REVEGETATION/REGENERATION STRATEGY

It is recommended that revegetation/regeneration of disturbed areas be undertaken on site for the following reasons:

- To maintain the existing level of integrity of vegetation communities within the EPZ;
- To maintain and potentially increase the floristic diversity currently exhibited within the EPZ;
- To ensure that degraded and managed areas regenerate with native endemic flora species;
- To stabilize areas subjected to weed management and cessation of grazing pursuits
- To restore cover and habitat diversity for the faunal assemblage following weed removal;
- To increase crown cover in open areas such that with the ongoing regrowth succession of the site there is potential for the existing communities to reach remnant status in the future.

In addition to the above, restoration of the 10 hectares of existing cleared/pasture areas is necessary to long-term protection to the retained vegetation communities from existing edge effects and ongoing fragmentation including:

- Abiotic effects: those changes in light, temperature, humidity and wind that occur when a remnant edge is formed by the creation of new surrounding land uses, such as clearing land for grazing, agriculture or urban development.
- Direct biological effects: include changes in the number and abundance of species brought about by changed environmental conditions (e.g. the spread of species that adapt well to the altered climatic conditions, and the reduction in recruitment of species that do not prosper).
- Indirect biological effects: are changes in the way species interact, particularly modified patterns of competition, pollination, and the dispersal of seeds (Greening Australia, 2000).

4.3 REVEGETATION/REGENERATION TYPES

It is suggested for the 10ha Rehabilitation Zone that the strategy of Assisted Natural Regeneration (with supplementary plantings where necessary) is the method that would prove feasible and effective. This type of strategy is outlined below in addition to the discussions previously offered in Section 4.0 above.

4.3.1 ASSISTED NATURAL REGENERATION (WITH SUPPLEMENTARY PLANTINGS)

Assisted Natural Regeneration (with supplementary plantings where necessary) is recommended for the 10ha Rehabilitation Zone. The entire 10ha has been subdivided into three smaller zones (Area/Zone 1A, 1B and 2) based upon location. Due to the large area of rehabilitation proposed, each zone has been broken into manageable units of 0.2 - 1 hectare.

The staging process shall occur as follows and has been selected to maximize potential for natural regeneration of endemic flora:

NATURAL REGENERATION AND WEED MANAGEMENT

This management stage shall involve the following:

- Ensuring cattle are removed from the relevant rehabilitation zone/stage.
- Monitoring and eradication of weeds as necessary

This process shall occur for a minimum of one year to five years (for later stages). Routine monitoring and maintenance shall be undertaken with corrective actions performed in incidences of non-compliance with set rehabilitation performance criteria (refer Section 4.5).

ASSESSMENT OF REGENERATION EFFORTS AND SUPPLEMENTARY PLANTING (PIONEER SPECIES)

This management stage shall involve the following:

- Assessing the success of the preceding natural regeneration to establish cover across the rehabilitation zone/stage.
- Where gaps in native cover occur, planting of pioneer trees and shrubs will be necessary in accordance with selected modules (refer Section 4.3.1.1). Pioneer species have been selected upon adjacent communities intended to be replicated and ability for pioneer species to establish quickly and shade-out weed species. Establishment of quick growing species will bring forward flowering and attraction of fauna to the rehabilitation zone. Birds and bats are likely to then deposit flora seeds from surrounding areas
- Weed monitoring and maintenance will be ongoing

This process shall occur over a period of one year.

ASSESSMENT OF REGENERATION EFFORTS AND SUPPLEMENTARY PLANTING (DIVERSITY)

This management stage shall involve the following:

- Assessing the success of the preceding natural regeneration and pioneer plantings to establish cover across the rehabilitation zone/stage.

- Assess the diversity of the flora assemblage to ensure a healthy mix of native species typical to the community being replicated is present (i.e. the community is not mono-specific except in intended areas).

- Where diversity is low, undertake diversity plantings from selected modules (refer Section 4.3.1.1). These species selected are based upon the existing adjacent vegetation communities, and species suitable for threatened fauna foraging

- Weed monitoring and maintenance will be ongoing

This process shall occur over a period of two years.

ASSESSMENT OF REGENERATION EFFORTS AND SUPPLEMENTARY PLANTING (GROUNDCOVERS)

This management stage shall involve the following:

- Assessing the success of the preceding natural regeneration, pioneer plantings and diversity plantings to establish cover and floristic diversity across the rehabilitation zone/stage.

- Assess the occurrence of native ground covers within the across the rehabilitation zone/stage. In some instances, native groundcovers may be suppressed in association with early regrowth communities. If ground covers are not sufficiently established than groundcover planting from selected modules shall be performed.

- Weed monitoring and maintenance will be ongoing

This process shall occur over a period of one year.

NATURAL REGENERATION AND WEED MANAGEMENT

This management stage shall involve the following:

- Assisted regeneration monitoring and maintenance (ongoing)

- Weed monitoring and maintenance (ongoing)

This process shall occur for the balance of the project time-frame. Routine monitoring and maintenance (refer Section 4.4) shall be undertaken with corrective actions (refer Section 4.6) performed in incidences of non-compliance with set rehabilitation performance criteria (refer Section 4.5).

4.3.3.1 DESCRIPTION OF ASSISTED REGENERATION ZONES

As discussed, the 10 hectare Rehabilitation Zone has been subdivided into three smaller zones based upon site location (Area/Zone 1A, 1B and 2). Each of these zones is described separately below with discussions provided regarding existing levels of natural regeneration, intended vegetation communities to be established and planting modules and supplementary planting (only required if regeneration is unsuccessful and to increase floristic diversity).

REHABILITATION ZONES/AREA 1A:

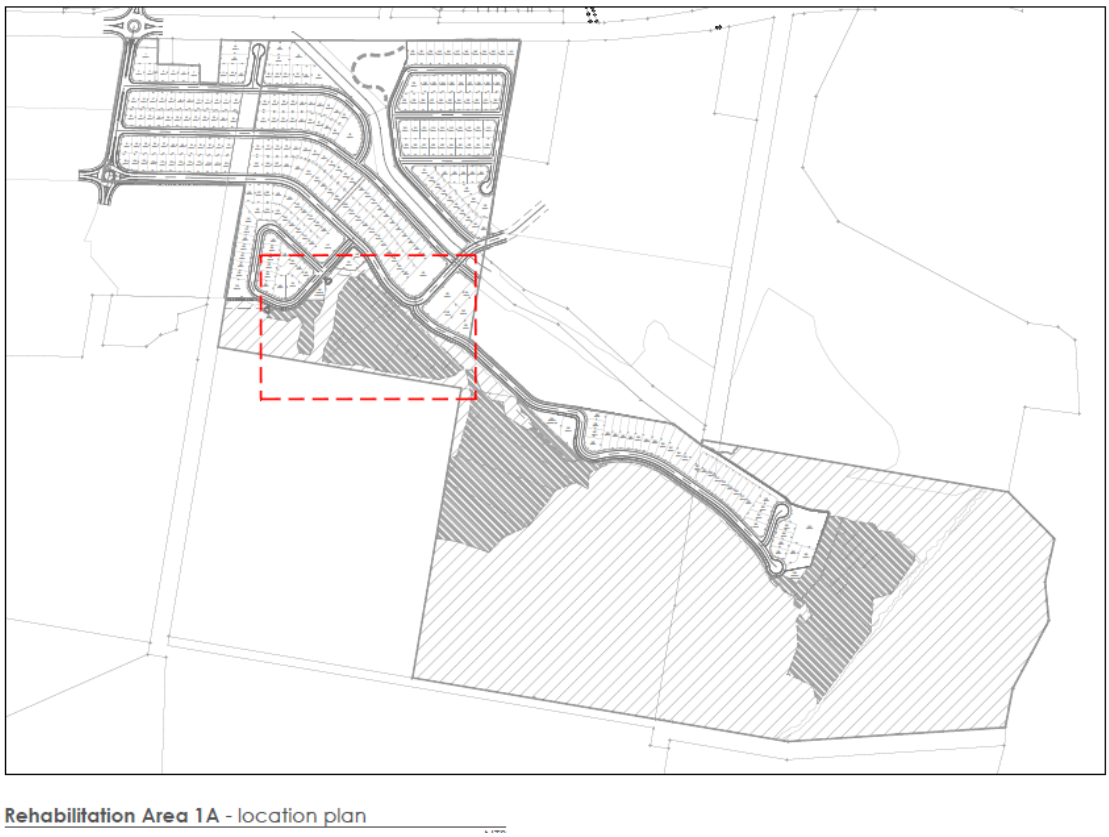


FIGURE 8: REHABILITATION ZONE/AREA 1A LOCATION PLAN

This rehabilitation zone covers ~2.52 hectares and will consolidate a fragmented corridor of swamp sclerophyll communities and provide habitat for acidic frogs and additional foraging material and habitat for local fauna species.

IMAGES OF REHABILITATION AREA/ZONE 1

IMAGES OF REHABILITATION AREA/ZONE 1

This zone/area (1A) has been broken down into management stages of approximately 0.3-1 ha to allow staged management as described within Section 4.2.1 above. Zone/area 1A will

be managed to establish a Freshwater Wetland with Wet Sclerophyll species utilized in the canopy and sub-canopy layers to provide additional foraging habitat for locally occurring fauna (i.e. koalas, flying-foxes, etc)

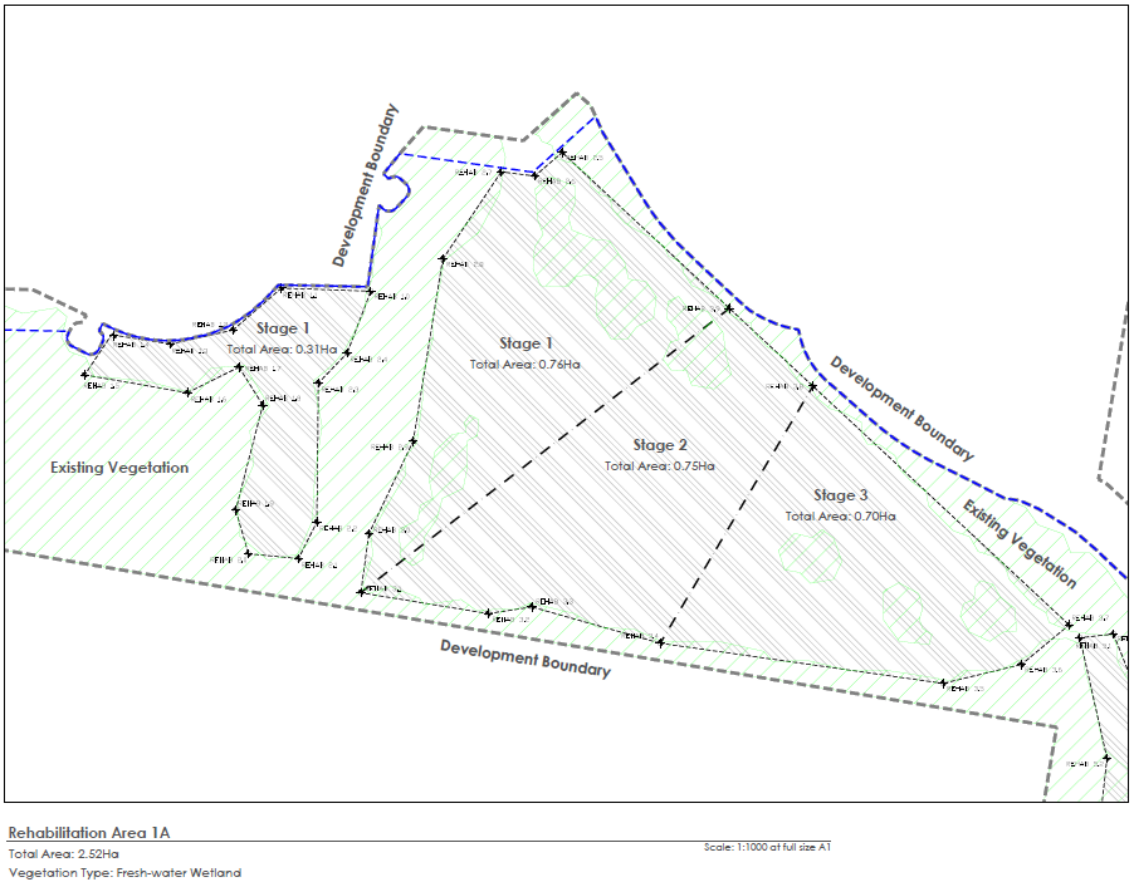


FIGURE 9: STAGING OF ZONE/AREA 1A (ALSO REFER ATTACHMENT 1)

Revegetation modules for each of the community types have been provided for use in association with 'pioneer', 'diversity' and 'groundcover' supplementary plantings if required (as described in Section 4.2.1 above). A full module and quantities (refer below and Attachment 1) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful.

However, the modules shall be utilized to select species and densities from to perform 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved (refer Section 4.5).

I.E. Natural regeneration canopy coverage will not be considered achieved for any one area if it does not contain a canopy or small tree typical to the community (refer Section 4.3.1 modules) within an area equal to or greater than 4sqm (i.e. if an area 2m x 2m does not contain any juveniles of required canopy tree/small tree than natural regeneration canopy cover is considered to be unsuccessful at that particular location).

In the event that such a location is deemed to occur then supplementary (pioneer species) planting shall be undertaken within the patch in accordance with Section 4.3.1.

For example, a patch of 10sqm within Rehabilitation Zone 1A is noted to be regenerated with native ground covers and/or shrubs but no tree species typical to the listed 'Swamp Sclerophyll' community occur. In this instance 4 x trees/small trees from the Rehabilitation Zone 1A are to be pocket planted at 140mm pot sizes within the patch.

Further discussions regarding performance requirements and triggers for canopy 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings are provided in Section 4.5.

REHABILITATION AREA 1A (252 MODULES)

TREES - module 1, 2

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	Casuarina glauca	Swamp Oak	4	140MM	1008
cal sal	Callistemon salignus	Willow Bottlebrush			
lop sau	Lophostemon sauveolens	Swampbox			
mel qui	Melaleuca quinquenervia	Paperbark			
euc rob	Eucalyptus robusta	Swamp Mahogany			
euc ter	Eucalyptus tereticornis	Forest Red Gum			

SEDGES, RUSHES + FERNS - module 1, 2

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
bau jun	Baumea juncea	Bare Twigrush	100 min 6 species per mod	75MM TUBE	
bau ter	Baumea teretifolia	Twigrush			
ble ind	Blechnum indicum	Bungwall Fern			
cen asi	Centella asiatica	Pennywort			
cyp pol	Cyperus polystachyos	Bunchy Sedge			Stage 1 10700
fim fer	Fimbristylis ferruginea	Rusty Fringesedge			
fim pol	Fimbristylis polytrichoides	Fuzzy Rush			
gah asp	Gahnia aspera	Saw Sedge			Stage 2 7500
jun kra	Juncus kraussii	Searush			
jun usi	Juncus usitatus	Common Rush			
phi lan	Philydrum lanuginosum	Frogsmouth			Stage 3 7000
phr aus	Phragmites australis	Common Reed			
sch val	Schoenoplectus validus	Clubrush			
sch lit	Schoenoplectus littoralis	Clubrush			
spo vir	Sporobolus virginicus	Salt Couch			
tri str	Triglochin striatum	Steaked Arrow Grass			
xyr com	Xyris complanata	Hatpins			