

Koala Beach Habitat Restoration Plan



Prepared for Tweed Shire Council and the Koala Beach Wildlife and Habitat Management Committee

Revised August 2021



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Cover photos: glossy black-cockatoos (Irene Timms), green-leaved rose walnut, koala (Denise Graveston)

1 Background

Koala Beach Estate is a residential development in Tweed Shire, located between Pottsville and Hastings Point. The estate includes 499 residential lots within 87.52 hectares of the 257-hectare site.

Koala Beach Estate is bounded on the east and southeast by the estuarine Cudgera Creek and on the north and northwest by Cudgen Nature Reserve. The property spans the south-eastern corner of land west of Cudgera Creek. Low-lying land to the west of the site is largely cleared and devoted to grazing and cultivation of sugar cane. Pottsville Environment Park adjoins Koala Beach to the south and reserves an area of native vegetation west of Cudgera Creek.

Prior to 1996 Koala Beach Estate and surrounding areas were predominantly used to graze cattle. Apart from the original homestead there were no residences on the site, access was limited, and there was little human activity. Prior to construction of a bridge across Cudgera Creek to facilitate development of Stages 1 and 2, vehicular access was restricted to a low-standard track from Round Mountain Road. A small area devoted to banana growing in the north of the site had been abandoned.

The majority of the southern 80 hectares now under residential development was previously cleared of the original forest communities and was interspersed with mixed exotic and native grassland, stands of native woodland or isolated native trees and parklands. Extensive swamp sclerophyll forest in the southern part of the site was previously cleared (likely 40 to 50 years ago) and now supports regenerating stands, presumably representative of original plant communities.

The past fire history of the site has not been recorded, however scarring on trees and the nature of the understorey suggests a relatively high frequency of low intensity burns prior to commencement of the Koala Beach development. The fires were probably used to promote ground layer growth for grazing purposes. Since 1996, the site has not been subject to fire.

2 Scope of the plan

The Habitat Restoration Plan was originally prepared in 2004 and was revised in 2012 and 2015. This revision has involved consultation with Tweed Shire Council officers from the different departments with responsibility for the management of open space, infrastructure and bushland in Koala Beach.

This plan is intended as a summary of the current condition and guide to the priorities for bush regeneration throughout the bushland at Koala Beach over the next five years.

Restoration activities identified in this plan incorporate actions and recommendations from the previous plans and individual threatened species and flora and fauna management and monitoring programs where appropriate.

3 Purpose and objectives

The purpose of this plan is to provide an update of the current coordinated approach to the on-ground habitat restoration of public lands on the Koala Beach Estate.

The objectives of the revised plan are as follows.

- Identify and map areas of public land into homogenous management classes according to the distinctive, on-ground management regimes required by each class.

- Map specific work units (work zones) within each management class and document the site-specific management required for each zone.
- Identify priorities for habitat restoration and management to improve the current condition of threatened species habitat and identify additional areas suitable for expansion of habitat.
- Provide guidance on best practice habitat restoration standards and procedures
- Identify opportunities to promote community involvement in the implementation of restoration actions.
- Incorporate relevant recommendations from fauna management plans and monitoring reports.

4 Management classes and responsibility

To achieve the objectives of this habitat restoration plan (refer Section 3) the site is divided into six homogeneous parts (management classes) that require distinctive management regimes – taking into account existing management, proposed new management prescriptions, current practice, and the Council unit responsible for implementation of on-ground works.

The six management classes are:

1. Bushland / habitat
2. Existing (established and new) and proposed native habitat plantings
3. *Arthraxon* management area
4. Bushfire Asset Protection Zones (APZs)
5. Local parks and sports fields
6. Sewage / drainage / water supply infrastructure

The management classes listed above are shown in Figures 2 and 3, and a description of each class is provided in the following sections.

A summary of the work zones is provided in the table below.

Work zones	Detail	Responsibility
Habitat restoration		
1 - 18, 21,23	Previous work done, follow-up or maintenance required.	S&E, under this plan
19 - 21	No previous work done, primary work required.	S&E, under this plan
24 - 26	Plantings at various stages of establishment, maintenance required.	S&E, under this plan
Other management types		
28 - 36	Parks & sports fields	P&AC
37 - 43	Asset Protection Zones	S&E, P&AC
44 - 49	Sewage, drainage, water infrastructure	R&S, S&E

(S&E: Sustainability and Environment, P&AC: Parks and Active Communities, R&S: Roads and Stormwater)

Detailed descriptions, extent of previous work and required management actions are provided for each of the work zones in Section 5.1 below, including specific actions identified in other management and monitoring plans for threatened species where relevant.

Note that since the previous (2015) version of the plan, some changes to work zone boundaries have been made. Zone 26 is an additional new planting, Zone 21 is community land managed by Tweed Shire Council. Zones 15 and 22 have been transferred to NSW National Parks and Wildlife Service (NPWS) to form part of Cudgen Nature Reserve and are no longer managed under this plan.

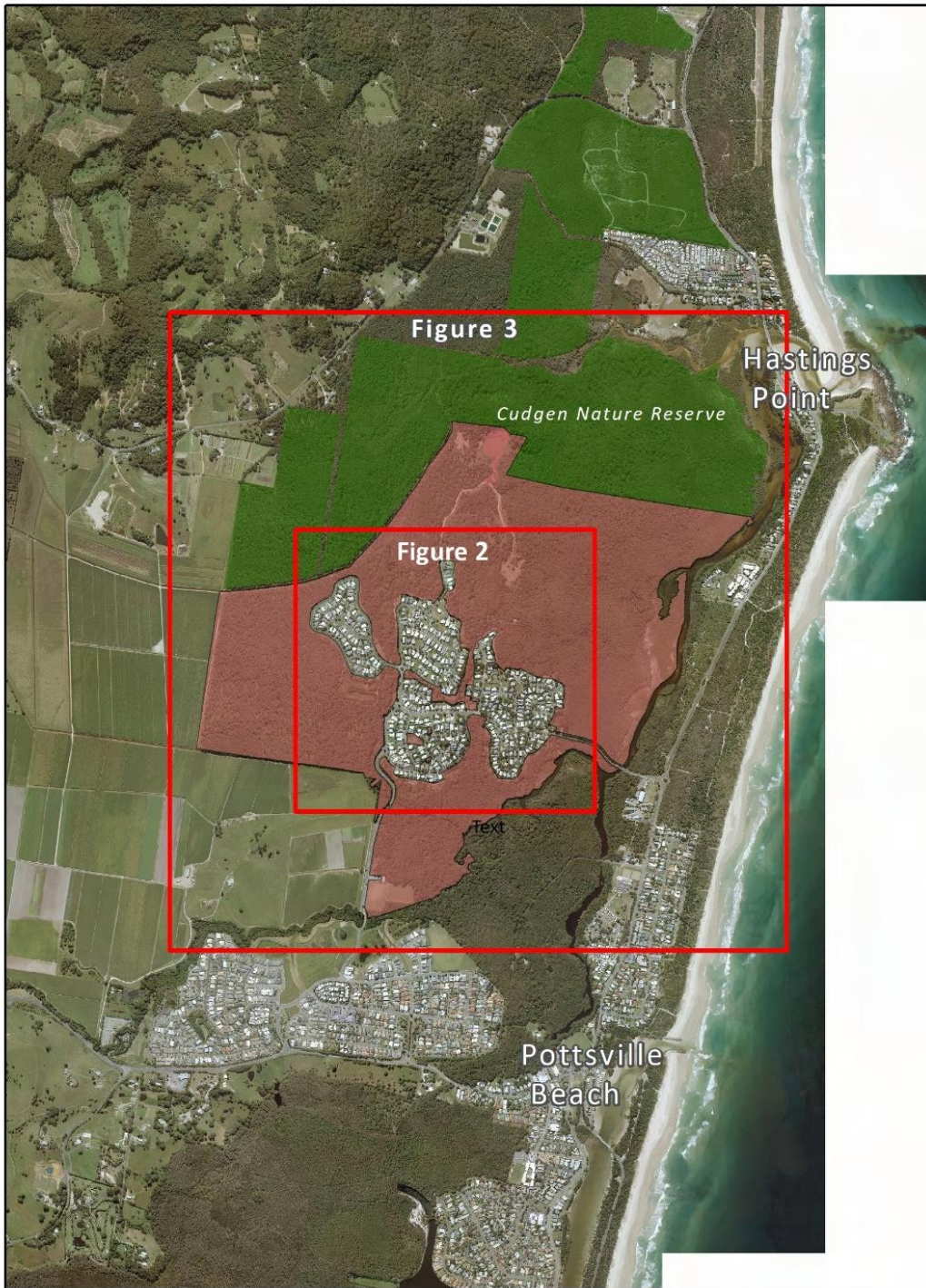

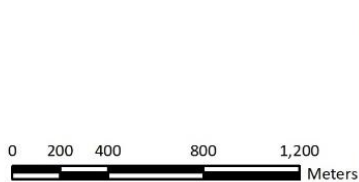


FIGURE 1
Key Map

 Land subject of Management Plan



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FIGURE 2
 Management classes
 Work zones

Management classes and managers

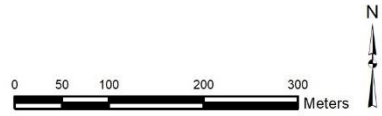
- Bushland/Habitat - S&E
- Existing and proposed plantings - S&E
- Arthraxon management area - S&E
- Core Arthraxon management area - S&E
- Bushfire APZ - S&E/P&AC
- Local parks and sports grounds _P&AC
- Sewage/drainage/water infrastructure - R&S

Note: Acronyms
 S&E - Sustainability & Environment
 P&AC - Parks & Active Communities
 R&S - Roads & Stormwater/Water & Wastewater
 APZ - Asset Protection Zone

- Prescribed APZ outer boundaries
- Management Tracks

Work zones

- Work zone boundaries
- Note: Numbers on figure refer to work zones.



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FIGURE 3 Management classes
Work zones

Management classes and managers

- Bushland/Habitat - S&E
- Existing and proposed plantings - S&E
- Arthraxon management area - S&E
- Core Arthraxon management area - S&E
- Bushfire APZ - S&E/P&AC
- Local parks and sports grounds_P&AC
- Sewage/drainage/water infrastructure - R&S

Note: Acronyms
 S&E - Sustainability & Environment
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 APZ - Asset Protection Zone

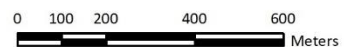
Note: Road verges and footpaths are managed by P&AC/R&S

Work Zones

- Work zone boundaries

Note: Numbers on figure refer to work zones.
 See Figure 2 for work zones not labelled in this figure.

- Holding facilities and Food tree plantation
- Management Tracks



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4.1 Bushland / habitat

These are areas of existing native vegetation where the principal proposed management is to reduce and then maintain the cover of exotic plant species to an appropriate level in order to improve and maintain habitat. The majority of the project area is in this class and includes a number of areas the subject of the existing habitat restoration plan. Tweed Shire Council's Sustainability and Environment (S&E) Unit is responsible for management of land in this class.

4.2 Plantings

Koala habitat plantings have been established on areas that were previously cleared land. Early plantings were funded by the developer and thereafter by Tweed Shire Council. The plantings are now well established and in future can be included in the Bushland / habitat management class. The northern plantings are less established being planted over the past three years by the Landcare group Friends of Cudgen Nature Reserve.

4.3 *Arthraxon* management area

This an area where a population of the threatened hairy joint grass *Arthraxon hispidus* occurs, located west of Lomandra Avenue. The core area containing the majority of the population is managed by Tweed Shire Council's S&E Unit under this plan. A grassed buffer is maintained around the core area by P&AC in conjunction with their routine slashing program.

4.4 Bushfire Asset Protection Zones

Council's S&E Unit manages a series of bush fire Asset Protection Zones (APZ) on the bushland interface of the Koala Beach Estate. These APZ were approved when each stage of the Koala Beach Estate were developed. In some cases, APZ extend onto privately owned residential lots.

An APZ is one of a number of bush fire protection measures that can mitigate the impact of bush fire attack on people and assets. Other types of protection measures include access, landscaping, water supply, building design and construction and emergency management.

The purpose of an APZ is to provide a buffer zone between a bush fire hazard (bushland) and an asset (i.e. house). The APZ is managed to minimise fuel loads and reduce potential radiant attack levels, flame, localised smoke and ember attack. Council slashes APZ on a regular basis throughout the year to ensure ground fuels are kept low. Annually prior to the bush fire danger period (typically 1 September to 31 March in Tweed LGA) APZ are inspected. Where required, additional mechanical hazard reduction work is then undertaken. This could result in the removal of regenerating trees and shrubs and the pruning or removal of entire trees. Wherever possible, preferred koala and glossy black-cockatoo food trees are preferentially retained in an APZ over commonly occurring tree species and trees of higher flammability (i.e. sclerophyll as opposed to rainforest).

4.5 Local parks and sports grounds

These areas are currently maintained by P&AC, who will retain sole responsibility for land in this class. S&E and P&AC are to jointly determine appropriate management of the common boundary that occurs between some natural areas and parks and sportsground.

4.6 Sewage / drainage / water supply infrastructure

Infrastructure assets including stormwater detention ponds, sewage and water pump stations and the water reservoir are located on lots that are adjacent to bushland or have some native vegetation on the lots. A significant part of the drainage infrastructure consists of watercourses and detention ponds with a considerable cover of native vegetation and fauna habitat. Council's Roads & Stormwater Unit is primarily responsible for management and maintenance of land in this class, with input from S&E should provide advice to ensure that habitat values are maintained. One drainage line (work zone 4) and the vegetated perimeter of stormwater detention ponds are managed by S&E (see Figure 2).

5 Work zones and management actions

5.1 Habitat restoration approach

The site has been divided into work zones within each management class to guide the implementation of works and ensure a systematic and comprehensive approach to restoration. The areas of each work zone are listed in Appendix 1.

The sequence of proposed works is based upon the need to arrest the degradation factors while maximising the regeneration potential in each zone. Seasonal weather conditions and the need to systematically follow up weed control have also been considered.

In general, work should commence in a single zone. On completion of primary and follow up work resulting in stabilisation of the zone, work then continues to the next zone. Due to the substantial primary work already undertaken across the site, work can now simultaneously continue in a number of adjoining work zones.

Continuing follow up or maintenance is essential for all zones where primary work has been undertaken. Commencement of work in those zones where primary work was undertaken in 2019 should be a priority following adoption of this plan.

A list of weeds for all restoration areas is provided in Appendix 2. Explanations of the weed treatment techniques are included in Appendix 3.

5.2 Habitat restoration for native fauna

Native fauna is a priority and primary consideration for habitat restoration at Koala Beach. The management of fauna is often linked to vegetation management and where relevant has been included in the actions detailed for individual work zones (refer Section 5).

Plans of management and monitoring plans have been prepared for some threatened fauna species; common blossom-bat, glossy black-cockatoo, coastal planigale and koala.

Listed below are the requirements for restoration actions specific to threatened fauna that are included in consent conditions and management plans.

- Common blossom-bat – Zone 1.
- Glossy black-cockatoo – Zone 2 and part zones 16 and 20.
- Coastal planigale – Monitoring locations in zones 2, 3, 8, 12, 19, 20, 21 and 22.
- Koala – conditions of consent required restoration of koala habitat in zones 3, 4, 5, 12, 13; koala food tree plantings in zones 24 - 26.
- Superb fruit-dove – conditions of consent required the planting of twenty small-fruited figs *Ficus obliqua*.

5.3 Bushland / habitat

The following 22 work zones are classified as bushland / habitat. Two zones (zones 15 and 22) that were identified in previous versions of the plan have recently been transferred to Cudgen Nature Reserve and are no longer managed under this plan.



Plate 1 – Large tallowwood, a koala food tree

Location and extent

Zone 1 is at the northern extent of Bottlebrush Drive and has an area of 1.35 ha.

Vegetation and habitat features

The vegetation is coast banksia *Banksia integrifolia* woodland extending to the north of the east west track along the ridge which divides Zone 1 from Zone 2 to the north.

The dominant weed is setaria *Setaria spachelata* which is interspersed throughout the native kangaroo grass *Themeda triandra* and scented top *Capillipedium spicigerum* in the south.

Additional weeds are minimal and include lantana *Lantana camara*, Rhodes grass *Chloris gayana*, cottonbush *Gomphocarpus fruticosus*, blue billygoat weed *Ageratum houstonianum*, whisky grass *Andropogon virginicus*, molasses grass *Melinis minutiflora*, broad-leaved paspalum *Paspalum mandiocanum*, winter senna *Senna pendula* var *glabrata*, rattlepod *Crotalaria* sp., climbing nightshade *Solanum seaforthianum* and giant devil's Fig *Solanum chrysotricum*.

Previous work

Zone 1 was previously dominated by exotic grasses and lantana. The entire zone has had weed control works that were initiated in 2004 in line with the management plan (Coburn & Markus 2000) these works have continued intermittently until the present time. The exotic grasses are significantly reduced and the recruitment of native grasses and coast banksia has been encouraged.

Threatened or significant species

Koala Beach Estate provides a regionally significant food resource for the common blossom-bat *Syconycteris australis* particularly during winter months. As such, the common blossom-bat reserve (Zone 1) was set aside during the development assessment process for Stage 4.

Koalas have been recorded within this zone.

Management issues

The blossom-bat monitoring reports (Hannah & Lewis 2007, 2010 and Hannah 2013) note that mature coast banksia on site are senescing and there is a lack of recruitment of the species. As coast banksia is a very important winter food source for the common blossom-bat at Koala Beach, the lack of recruitment is of concern.

The current monitoring report (Hannah, D., Lollback, G. and Lewis, B (2020)) recommends continuing control of woody weeds and exotic grasses and protection of new seedlings with tree guards to protect from browsing. The 2020 report also recommended establishment of six 10m x 10m plots (see Plate 2) to monitor weed control, removal of native macaranga and supplementary coast banksia planting trials within the site.

Management actions

Maintenance spraying should be performed by experienced bush regenerators to encourage native groundcovers to expand and dominate the ground layer. Continue to promote regeneration of coast banksia in the area.

Commence work at the south east corner and work north throughout the zone.

- Spot spray throughout to control grasses, other groundcover weeds and resprouting woody weeds. Care is required to ensure that native grasses and groundcovers are not sprayed, the setaria and scented top appear similar in appearance unless in flower.

- Spot spray blady grass where it is competing with recruitment of coast banksia and other native plants.
- The area to be followed up on three monthly basis.
- Within the six established trial plots, spray or brush cut groundcover weeds, rake or remove treated groundcover, stem inject and cut back pioneer rainforest species and plant coast banksia seedlings. Undertake base line and annual monitoring to measure recruitment and establishment of plantings.
- Monitor weed regrowth and manage as necessary with the aim to control exotic grasses and other weeds before they reach maturity and produce seed.
- The ridge and entrance tracks are to be maintained by slashing at regular intervals to retain a firebreak. Care is to be taken to remain within the current formation to avoid damage to native vegetation. P&AC is to retain responsibility for slashing of the track with S&E to be responsible for monitoring.



Plate 2 – Location of plots to monitor establishment of planted *Banksia* and recruitment after weed control.

Related documents

- Plan of Management for the Queensland Blossom-bat *Syconycteris australis* on the Koala Beach Residential Estate, 2000 (Coburn & Markus 2000).
- Blossom-bat Monitoring Report, Koala Beach Estate, Winter 2007 Report (Hannah & Lewis 2007), Winter 2010 (Hannah & Lewis 2010), Winter 2013 (Hannah 2013), Winter 2020 (Hannah, D., Lollback, G. and Lewis, B 2020).

Location and extent

Zone 2 is located north west of Melia Close and to the north of the ridge track dividing this zone from Zone 1. The zone has an area of 1.87 ha.

Vegetation and habitat features

The vegetation is forest oak *Allocasuarina torulosa* woodland to forest.

Weeds are generally at low density and include setaria in wet gullies and scattered lantana, broad-leaved paspalum, corky passionfruit *Passiflora suberosa*, narrow-leaved cottonbush and ground asparagus *Protasparagus aethiopicus*.

Previous work

The zone was previously dominated by dense lantana and exotic grasses in the gullies and along edges with large patches of lantana and exotic grasses scattered throughout. Native grasses and groundcovers have established throughout the zone. The entire zone has had intermittent primary and maintenance weed control works since 2004. The upper areas had follow up in late 2018 and lower slopes in October 2019.

Threatened or significant species

In addition to glossy black-cockatoos, the threatened pink nodding orchid *Geodorum densiflorum* has been recorded on the upper slopes of the zone. Koalas also move through this area.

Coastal planigale monitoring works are undertaken in this zone, with coastal planigale recorded here.

Management issues

The Glossy Black-cockatoo Koala Beach Monitoring Report (Fitzgerald 2019) concludes “Mortality and senescence of forest oaks within the reserved habitat stands and their vicinity remained at a low and stable rate”.

Dumping of garden waste and rubbish has become a problem where houses back onto lower slopes of the zone.

Considerable disturbance has occurred during construction of a mountain bike track along the north east ridgeline. This track has been remediated and currently is not being used.

Management actions

Commence work at the south east corner of the zone on the northern side of the ridge track working east to west across the zone moving north.

- Spot spray throughout to control grasses, other groundcover weeds and resprouting woody weeds. Care is required to ensure that native grasses, groundcovers and the Pink Nodding Orchid are not sprayed;
- Coolatai Grass infestation to be monitored each visit and hand weeded with seed bagged and removed from site;
- Woody weeds are to be cut, scrape and painted. Smaller lantana can be hand pulled.
- Continue follow up on a regular two to four monthly basis depending on the season.
- Monitor for garden waste and dumping, clean up and notify Council.

Related documents

- Plan of Management for the Glossy Black-cockatoo at the Koala Beach Estate (Fitzgerald 2000)
- Glossy Black-cockatoo Koala Beach Monitoring Reports (Fitzgerald 2005, 2007, 2009, 2011, 2014, 2017, 2019)

Zone 3 Muskheart

Location and extent

Zone 3 is north of Muskheart Avenue and extends south from Zone 1. The zone has an area of 6.39 ha.

Vegetation and habitat features

The northern section is brush box *Lophostemon confertus* and mixed eucalypt forest with rainforest understorey changing to broad-leaved paperbark *Melaleuca quinquenervia* and swamp oak *Casuarina glauca* forest in the south.

Previous work

The zone had previously been dominated by dense lantana in the gullies and exotic grasses along edges extending into the forest. The entire zone has had primary and maintenance weed control works from 2004 to 2006. Follow up works commenced again in 2014. Follow up continued in late 2019 and 2020. The zone has remained in good condition with lantana, tobacco bush *Solanum mauritianum* and exotic grasses beginning to re-establish particularly in gullies and on edges.

Threatened or significant species

A glossy black-cockatoo watering site is known from within this work zone. Additionally, there are a number of artificial nesting hollows for glossy black-cockatoos in this zone.

Coastal planigale monitoring works are undertaken in this zone, and coastal planigale has been recorded here.

Management issues

Weed is minimal and is generally confined to the edge adjacent to the asset protection zone (APZ) and open gaps colonised by exotic grass. Previously, garden waste dumping was occurring in the APZ and work zone, however this practice seems to have ceased.

In 2020 a bike jump track was created and caused significant disturbance to soil and vegetation on the edge of this zone. Since this time signs have been erected and usage of this track discouraged. Monitoring will continue to discourage the unauthorised use of this zone for bike riding.

Management actions

Commence work at the south east corner and work in an east west direction moving north throughout the zone to link with Zone 1.

- Spot spray throughout to control grasses, other groundcover weeds and resprouting woody weeds.
- Control native vines where impacting on native trees and shrubs.
- Follow up on regular three to four monthly basis.

- Monitor for garden waste dumping.

Related documents

- Plan of Management for the Glossy Black-Cockatoo at the Koala Beach Estate (Fitzgerald 2000)



Plate 3 – Northern section of Zone 3 Muskheart

Location and extent

Zone 4 is between Bottlebrush Drive and Marsupial Drive and is the area known as Upper Grey Gum Gully. The zone includes an extension to include the drainage line from the sediment pond to Macadamia Avenue. P&AC previously managed the watercourse. The zone has an area of 0.75 ha.

Vegetation and habitat features

This zone is long and narrow but the gully habitat is important as habitat for koalas and provides a vegetated link between the north and south.

The northern section is woodland with the upper stratum dominated by small-fruited grey gum, and a mixed rainforest understorey.

The southern section is regrowth subtropical rainforest dominated by guioa and foambark.

Previous work

The zone was previously dominated by lantana in the lower gully and exotic groundcovers such as mistflower *Ageratina riparia*, crofton weed and fishbone fern *Nephrolepis cordifolia*. Exotic grasses dominated the drain section. The entire gully has had intermittent primary and maintenance works from 2004 until the present time. The drain has had works commencing in 2009 and continuing to January 2011. Weeds were treated in 2019. Council has slashed to the edges of the gully as part of maintenance of the asset protection zone.

A small supplementary planting of mixed koala food trees has been undertaken at the head of the gully with most trees well grown and tree guards removed.

The restoration of the drain on the west provides an example of the use of naturally regenerating native grasses and sedges (See Plate 17).

Threatened or significant species

Koalas are known to utilise this work zone.

Green-leaved rose walnut *Endiandra muelleri* subsp. *bracteata* is present in the southern section of this work zone.

Management issues

Weeds continue to invade this zone due to its small and narrow configuration and because it is surrounded by parks and residential yards. Exotic grasses, Singapore daisy and black-eyed Susan *Thunbergia alata* are growing into the gully from neighbouring backyards. Some larger giant devil's fig and tobacco bush is establishing. Bush regenerators continue to work downstream, along the drain to Lomandra Ave. Exotic grasses and invasive species including winter senna and giant devil's fig are also treated in adjacent Council parkland and gardens to reduce weed spread into the zone.

Dumping of garden waste is a threat in this zone. Exotic grasses in mown areas of the adjoining APZ rapidly grow and produce seeds during spring and summer seasons reinfesting edges of the zone.

Management actions

Commence work at the northern end of the zone working to the south to the sediment pond then west along the watercourse.

- Council to notify adjacent landholders of the importance of the zone and the restoration being undertaken. Include information on native grasses and sedges and appropriate species for planting in adjacent gardens.
- Council to remove rubbish from drain and surrounding area.
- Spot spray throughout the zone taking care to avoid native grasses and sedges.
- Selectively control native vines where damaging native trees.
- Follow up on a regular three to four monthly basis.
- Monitor for garden waste dumping, clean up and follow up with residents as required.
- Investigate potential for planting propagated green-leaved rose walnut in the vicinity of the single plant in Upper Grey Gum Gully.

Additional information

Areas of still, fresh water within Zone 4 provide potential breeding and foraging habitat for cane toads.

Related documents

- Management Plan for the Endangered Plant Rusty Green-leaved Rose Walnut *Endiandra muelleri* subsp. *bracteata* on Stage 3 of the Koala Beach Estate, Tweed Shire (Benwell 2002).
- NSW Recovery Plan *Endiandra muelleri* subsp. *bracteata* (Green-leaved Rose Walnut) and *Endiandra hayesii* (Rusty Rose Walnut) (DEC 2004)

Zone 5 Lower Grey Gum Gully

Location and extent

Zone 5 is between Sassafras Street and Macadamia Drive and is the area known as Lower Grey Gum Gully. The zone has an area of 2.75 ha.

Vegetation and habitat features

The vegetation is small-fruited grey gum *Eucalyptus propinqua* forest grading into broad-leaved paperbark forest. This zone was identified as important habitat for koalas in particular females with young. Koala food trees were planted in the zone in 2002 by a local community group and in 2006 by Australian Koala Foundation volunteers.

Previous work

The zone had previously been dominated by dense patches of lantana which extended into the canopy, dense corky passionfruit growing into the canopy and a dense groundcover of exotic grasses. The entire zone has had primary and intermittent maintenance works from 2004 to late 2019. The dense groundcover of exotic grasses has been converted to native rainforest species and Lantana was virtually absent when primary works were completed. The trees from the 2002 planting are up to 15 metres high and the 2006 plantings are well established. Threatened or significant species

Glossy black-cockatoo, koala and coastal planigale have been recorded from this work zone.

Koala monitoring is undertaken in this zone.

Management issues

Winter senna, giant devil's fig and Lantana persist around the pond on the lower edge of the zone. Passionflower species and exotic grasses require control throughout the zone. Outbreaks of coral creeper are treated along the south-east edge of the zone.

Garden waste has been dumped on the eastern edge generally within the Asset Protection Zone including highly invasive garden plants.

This zone has also been subject to destructive bike track creation. As with Glossy Black-Cockatoo and Muskheart work zones, tracks will be monitored, remediated where required and unauthorised use of this zone for bike riding discouraged.

Management actions

- Commence work at the north of the zone working in an east to west direction moving south.
- Council to notify adjacent landholders of the importance of the zone and the restoration being undertaken.
- Monitor for garden waste dumping, clean up and follow up with residents as required;
- Spot spray smaller woody weeds, grasses and groundcover weeds throughout. Where Corky Passionfruit is dense on the ground spot spray. Care where native grasses and groundcovers are present;
- Follow up at three month intervals. Work to be carefully timed before weeds reach maturity and produce seed.

The koala food tree small-fruited grey gum has limited recruitment throughout the gully. Natural recruitment is generally dominated by rainforest species and native groundcovers which include dense areas of native rainforest grasses. Small-fruited grey gum should be included in any future plantings.

Disturbance trials (including burning) within monitoring plots were set up by students from Murwillumbah TAFE in April 2008. The trials were to determine methods to encourage recruitment of small-fruited grey gum. No recruitment of small-fruited grey gum was recorded in 2008-2009. Additional trials could be undertaken in conjunction with work in Blossom-bat Reserve (Zone 1) to encourage regeneration of coast banksia. Planting to be considered if there is no natural regeneration.

Additional works required

Artificial nesting hollows have been installed within this work zone, which need to be monitored and maintained on a bi-annual basis.



Plate 4 – Lower Grey Gum Gully - native groundcovers including koala bells *Artanema fimbriatum* benefit from control of exotic grasses

Zone 6

Entrance North

Location and extent

Zone 6 is north of Cudgera Avenue as it enters Koala Beach and extends south from Zone 20 then east across to Cudgera Creek. The northern boundary is the track which leads from the APZ east to the creek. The zone has an area of 8.67 ha.

Vegetation and habitat features

The vegetation is swamp mahogany *Eucalyptus robusta* and tallowwood *Eucalyptus microcorys* forest grading into broad-leaved paperbark forest in the east.

Previous works

The zone had previously been dominated by dense patches of lantana and exotic grasses mainly along the western edge. There were large patches of bitou bush towards the creek. The entire zone has had primary and intermittent maintenance works from 2007 until the present time. The previous works were concentrated along the western edge with works extending throughout the zone on one occasion mainly to control bitou bush. In 2019 bitou bush was controlled along the tidal eastern edge. Outbreaks of coastal morning glory behind the pump station and in forest on the south east corner are responding well to treatment.

Threatened or significant species

This zone is an important area of koala habitat which have been recorded from this work zone. Large-footed fishing bat *Myotis macropus* and little bent-wing bat *Miniopterus australis* roosts underneath the bridge over Cudgera Creek.

Management issues

Weeds are minimal with small and very isolated lantana, broad-leaved paspalum, bitou bush, umbrella tree and corky passionfruit. Weeds along the western edge include corky passionfruit, setaria, broad-leaved paspalum, blue billygoat weed and tobacco bush.

Care should be taken when working in this zone not to disturb the threatened microbat colony roosting under Cudgera Creek bridge.

Management actions

- Commence work at the north-west corner adjacent to Zone 3 and work in an east west direction moving south to Cudgera Avenue.
- Spot spray grasses and groundcover weeds throughout. Care is to be taken where native grasses and groundcovers are present.
- Cut, scrape and paint or hand pull larger woody weeds.
- Follow up at regular three to four monthly intervals.

Additional works required

Artificial nesting hollows have been installed within this work zone. These need to be monitored and maintained on an annual basis

Zone 7 Entrance South

Location and extent

Zone 7 is south of Cudgera Avenue as it enters Koala Beach, extending west to south of Cudgera Avenue to link with Zones 5 and 8. The zone has an area of 4.40 ha.

Vegetation and habitat features

The vegetation is broad-leaved paperbark and swamp oak forest.

Previous works

Lantana and exotic grasses had previously dominated the zone. The zone has had limited previous works in the western section mainly to control dense lantana behind the houses. Works in this zone were undertaken as an extension of Zone 5 in the later parts of the 2004-2006 works program. Follow up was undertaken in December 2018 and again in September 2019 to control regrowth of senna and exotic grasses. Native groundcovers are expanding and the occurrence of weeds is greatly reduced.

Threatened or significant species

Koalas have been observed in this work zone. Bush stone-curlews are also known from the adjacent APZ and residential gardens.

Management issues

Weeds include dense setaria and broad-leaved paspalum on edges, clumps of lantana and scattered winter senna, corky passionfruit, climbing nightshade in the east grading to scattered or isolated plants in the west.

Care should be taken when working in this zone not to disturb the colony of the threatened microbats roosting under Cudgera Creek bridge.

Management actions

- Commence work at the bridge and work in a north south direction moving to the west.
- Spot spray grasses, groundcover weeds and lantana.
- Follow up spot spray throughout on regular three to four monthly basis.

Additional works required

There is a gap between the vegetation and bollards along the creek in the south eastern corner of the zone. It is recommended that Council investigates extending the bollards to minimise impact on the creek bank.

Artificial nesting hollows have been installed within this zone. These need to be monitored and maintained on an annual basis.



Plate 5 – Gap in vegetation on northern bank of Cudgera Creek

Location and extent

Zone 8 extends south west from Zone 5 (Lower Grey Gum Gully) south of Macadamia Avenue west to Tom Merchant Drive and south to the east west drainage line. The zone extends to plantings in the west. The zone has an area of 7.64 ha.

Vegetation and habitat features

The vegetation varies from swamp oak forest with eucalypt and rainforest species in the mid stratum along the northern edge to broad-leaved paperbark, brush box *Lophostemon confertus* and pink bloodwood *Corymbia intermedia* / swamp mahogany forest in the south. There are two exotic pine plantations in the east adjacent to the creek.

Previous works

The zone has had limited previous works along the northern edge south of the APZ and along the roadside on the west. These works were an extension of Zone 5 works during the 2004-2006 works program. Extensive works were undertaken in 2019 with the dry weather providing the opportunity to manually work in the low lying area to control dense winter senna, lantana and slash pine. Camphor laurel, giant devil's fig, umbrella tree and groundsel were also treated during 2019 primary work. There are additional areas of slash pine and dense winter senna still to be treated in this zone.

Threatened or significant species

Koalas have been recorded in this zone.

Koala and coastal planigale monitoring works are undertaken within this zone.

Scented acronychia *Acronychia littoralis*, an endangered plant species, has been recorded in this zone close to Cudgera Creek.

Management issues

Weeds include climbing nightshade seedlings and some mature plants, coastal morning glory *Ipomoea cairica*, lantana and dense mature winter senna and slash pine. There are patches of dense exotic grasses including setaria, broad-leaved paspalum and Rhodes grass. East and south of Macadamia Drive in dry areas, and to a lesser degree in wet areas, there are dense patches of lantana and winter senna and scattered tobacco bush, bitou bush, climbing solanum and giant devil's fig.



Plate 6 – Macadamia South - bush regenerators work through dense winter senna dominating much of the midstory

Management actions

Commence work at the north-west corner working in a north south direction to the east then change direction and work east west towards the creek.

- Cut, scrape and paint lantana, winter senna, climbing nightshade and other woody weeds.
- Spot spray small weed seedlings and exotic grasses and groundcovers.
- Overspray larger patches of lantana and leave in situ.
- Drill and inject large exotic slash pine. As a priority control pines where they are adjacent to native trees to allow for native tree expansion and recruitment into the area currently occupied by the pines.
- Follow up spot spray throughout the zone.
- Follow up drill and inject and cut, scrape and paint throughout the two exotic pine plantations.
- Follow up western section after three months and eastern section after two months then continue at three to four monthly intervals.

Related documents

- Control Plan for Cane Toads, Koala Beach Estate, Tweed LGA (Gray 2011)
- Planigale maculata Monitoring Report, Koala Beach Estate Spring 2007 (Hannah 2007, 2012, 2015)

Location and extent

Zone 9 is located north of the sporting fields and extends from Tom Merchant Drive east to Zone 10. The zone has an area of 9.05 ha.

Vegetation and habitat features

The vegetation is swamp oak forest with spring grass *Erichloa procera*, sea celery *Apium prostratum*, grassland/forbland and swamp oak forest with low lying areas dominated by phragmites *Phragmites australis* grassland.

Previous works

The zone has had minimal previous works restricted to the western edge along the roadside as part of the 2009-2010 planting maintenance program. The eastern section has had no previous works as evidenced by the presence of dense weeds in the higher areas. Sections of the zone are regularly inundated.

Threatened or significant species

Koalas have been recorded from this zone.

Management issues

Weeds include winter senna, lantana, climbing nightshade, broad-leaved paspalum, setaria, bahai grass, giant devil's fig, groundsel bush, tobacco bush, blue billygoat weed, wild aster, broad-leaved carpet grass and cuphea.

Management actions

- Commence work at the north-west corner working in a north south direction from the drain to the club house moving east to Zone 10 and the creek.
- Cut, scrape and paint lantana, groundsel, winter senna, climbing nightshade and other woody weeds.
- Spot spray exotic grasses and groundcovers and smaller woody weeds.
- Overspray larger patches of lantana and larger groundsel and leave in situ.
- Follow up spot spray throughout the zone.
- Follow up throughout the zone at regular two to three monthly intervals then when stabilised continue at three to four monthly intervals.

Location and extent

Zone 10 is east of the sports fields and extends to the southern boundary of Koala Beach along Cudgera Creek. The zone has an area of 4.65 ha.

Vegetation and habitat features

The vegetation varies from swamp oak forest near the sports fields to sedgelands closer to the creek. In the north there is an area of brushbox forest with a mid-stratum of rainforest species. There is a planting adjacent to the south west corner of the zone.

Previous works

The zone had primary works commenced in 2010 in the south adjacent to the creek as compensation for vegetation loss during construction of the bridge over Cudgera Creek. Work has extended north along the east of the sports fields. The site has transformed from a degraded, weed infested area to diverse natural habitat with minimal weeds. Primary work is required in the north west. Plantings extend along the south and south east of the sports fields.

Threatened or significant species

Koala monitoring is undertaken in this zone.

Koalas have been recorded in this zone.

Management issues

Weeds include broad-leaved paspalum, setaria, Rhodes grass and dense winter senna along the creek and setaria and broad-leaved paspalum in open areas. There is scattered camphor laurel on the creek and corky passionfruit, umbrella tree, Cocos palm *Syagrus romanzoffiana*, lantana and climbing nightshade to the west of the creek. The southern creek bank located in Pottsville Environment Park has had weed control.

Management actions

- Commence work at the plantings on the Tom Merchant Drive and work in a north south direction moving to the east.
- Cut, scrape and paint lantana, winter senna and woody weeds.
- Spot spray throughout the zone to control exotic grasses and groundcovers and smaller woody weeds.
- Follow up throughout the zone on a regular basis initially at two to three monthly intervals then continue at three to four monthly intervals.

Additional information

Council provides ongoing funding to control dense weed on the southern bank of Cudgera Creek within Pottsville Environment Park. This action has reduced weed re-introduction in this zone.

Related documents

- Pottsville Environment Park Restoration Plan (BRS 2011)

Location and extent

Zone 11 is west of Macadamia Drive and Lomandra Avenue and extends to the drainage reserve south of Sugar Glider Drive. The zone excludes the Arthraxon Management Area and drainage line to the sediment ponds and plantings in the south. The zone has an area of 2.53 ha.

Vegetation and habitat features

The vegetation is swamp box /swamp oak forest with rainforest species in the mid stratum. There are plantings adjacent to the south east. There is dense setaria and broad-leaved paspalum in open areas.

Previous work

The zone has had minimal previous works confined to the west of the Arthraxon Management Area and a small area to the south. Council has removed the woody weeds and vegetation around the drainage line in the north.

Threatened or significant species

Koala monitoring is undertaken in this zone.

Management issues

The major weed is setaria, broad-leaved paspalum and cuphea with occurrences of blue billygoat weed and other groundcover herbs. The southern section has setaria and broad-leaved paspalum on edges, and large lantana and winter senna, corky passionfruit, scattered giant devil's fig and climbing nightshade.

Management actions

- Work to commence in the north along the southern edge of the drainage line working in an east west direction moving to the south.
- Spot spray to control introduced grasses, cuphea and other groundcover weeds throughout forested area including the 5m buffer on east along the forest edge and through the planting. Care to be taken as *Arthraxon* is likely to occur along the edge.
- Cut, scrape and paint woody weeds including lantana, winter senna and giant devil's fig.
- Overspray dense patches of lantana and leave in situ.
- Cut corky passionfruit at head height and roll up base and hang up in fork of tree.
- Follow up spot spray throughout the zone.
- Follow up at three monthly intervals until exotic grasses are under control and then at three to four monthly intervals.
- Following significant weed control, investigate any potential areas for planting.

Location and extent

Zone 12 is between Lomandra Avenue and Sugar Glider Drive and excludes the Dunghir Aboriginal Site (Zone 13). The zone has an area of 5.42 ha.

Vegetation and habitat features

The vegetation is broad-leaved paperbark and swamp oak forest with areas of brushbox.

Previous work

Dense lantana and exotic grasses had previously dominated the zone. The zone had previous works as part of the 2004-2006 works program, with minimal follow up to 2009. Follow up commenced in 2012 continuing intermittently to 2019. Primary works were extended in 2019 along northern and eastern edges.



Plate 7 – Tongue - patches of juvenile umbrella trees were controlled during maintenance

Threatened or significant species

Koala and coastal planigale monitoring works are undertaken in this zone. Koalas have been recorded in this zone. Bush stone-curlews are also known from the adjacent APZ and residential gardens.

Management issues

Weeds are mainly in the section along Christies Creek where there was a dense cover of broad-leaved paspalum and patches of lantana. Coastal morning glory is located on the western edge. Other weeds include scattered setaria, crofton weed, blue billygoat weed, mistflower, cuphea, and winter senna. Winter senna requires primary work in the northern section.

Dumping of garden waste occurs along the edges. Large areas of this zone remain inundated during wet weather.

Management actions

- Commence work at the southern tip and work in an east west direction moving north to Christies Creek.
- Spot spray all introduced grasses, groundcover weeds and small woody weeds.
- Cut, scrape and paint larger woody weeds including Winter Senna and Lantana in northern section.
- Control vines where impacting on native trees and shrubs.
- Follow up on a regular basis at three to four monthly intervals.

Zone 13 Dunghir Aboriginal Site

Location and extent

Zone 13 is located north west of Lomandra Avenue and has been fenced along Lomandra Avenue to protect an Aboriginal cultural heritage site. The zone has an area of 1.76 ha

Vegetation and habitat features

The vegetation is tallowwood / small-fruited grey gum open forest.

Previous work

The zone has had previous works along the southern edges. These works were an extension of Zone 12 in the 2004-2006 works program. Primary and follow up works have been undertaken intermittently from 2012 to 2019.

Threatened or significant species

Koalas and coastal planigales are known from this zone.

Coastal planigale monitoring works are undertaken in this zone.

Management issues

Weeds include lantana, winter senna, tobacco bush, broad-leaved paspalum, setaria, whisky grass, corky passionfruit and camphor laurel *Cinnamomum camphora*. The zone is a hotspot for *Solanum* weed species and introduced *Passiflora* species.

Management actions

- Commence work at the south east corner and work in an east west direction moving north.
- Spot spray grasses and groundcover weeds including emerging *Solanum* and *Passiflora* species.
- Cut, scrape and paint lantana, winter senna and other woody weeds.
- Continue regular spot spray to ensure that persistent weeds do not re-establish.
- Follow up at regular two to three monthly intervals then extend to four monthly intervals.

Related documents

- Cultural Heritage Management Plan for Stages 5 and 6 (Aspect North 2004)



Plate 8 – Signage and good condition forest in the south of Zone 13

Zone 14 Compensation

Location and extent

Zone 14 is located north and west of Lomandra Avenue. The zone has an area of 2.62 ha.

Vegetation and habitat features

The vegetation is swamp oak forest with dense groundcover of setaria and broad-leaved paspalum. The eastern section of the zone was subject to unauthorised clearing and required compensatory work including weed control and plantings.

Previous work

The zone had previously been dominated by dense groundcover of exotic grasses. The entire zone had primary works from 2007 until 2009. The primary works resulted in native groundcovers replacing the dense exotic grasses and groundcovers. Due to lack of follow up, dense exotic grasses, lantana and cuphea have re-invaded the zone. The zone requires primary and follow up work.

Threatened or significant species

Koalas are known from this work zone. Koala monitoring is undertaken in this zone.

Management issues

The dominant weeds are the grasses, setaria and broad-leaved paspalum. Other weeds include blue billygoat weed, cuphea, mistflower, winter senna, lantana and isolated bitou bush.

Management actions

- Commence work at the south west corner working in an east west direction moving north.
- Spot spray grasses and groundcover weeds. The initial spray to be selective and concentrate on areas previously worked, adjacent to native groundcovers and to the drip line of native trees and shrubs. Gradually increase the area of exotic grasses controlled, staged to keep pace with the natural regeneration of groundcovers and seedlings.
- Cut, scrape and paint lantana, winter senna and other woody weeds. Cut into billets.
- Continue regular spot spray to ensure that exotic grasses do not re-establish.
- Follow up at regular two monthly intervals then extend to three to four monthly intervals.

Zone 15 The Barrage

Zone 15 located in the north east of the site adjacent to Christies Creek has been transferred to Cudgen Nature Reserve.

Zone 16 Christies

Location and extent

Zone 16 is north of work Zones 2 and 14 and extends to Christies Creek. The northern and eastern boundaries extend to Zone 21. The access track from the end of Lomandra Avenue to Zone 21 divides the zone. The zone has an area of 9.03 ha.

Vegetation and habitat features

The vegetation is swamp oak forest with ground stratum of broad-leaved paspalum. In the north east on higher areas there is kangaroo grass under swamp oak / brushbox forest and an area of tallowwood / grey ironbark *Eucalyptus siderophloia* forest.

Previous work

The zone has had minimal previous work on the east of the access track being an extension of the 2004-2006 works program in Zone 2 Glossy Black-Cockatoo. These works had previously extended to the track and included plantings of forest oak. There have been no previous works west of the track as evidenced by the density of weeds.

Threatened or significant species

Koalas are known from this zone. The north-eastern section of this zone is glossy black-cockatoo habitat. Coastal planigale have also been recorded in this zone.

Koala monitoring is undertaken in this zone.

Management issues

The major weeds are the dominant groundcovers broad-leaved paspalum and setaria. Other weeds include winter senna, lantana, camphor laurel and corky passionfruit. The eastern section has scattered weed which increases in density west of the track.

Management actions

- Commence work at the boundary with Zone 2 and work in an east west direction moving north initially to the track then work the western section to the creek.
- Spot spray throughout the eastern section to control the exotic grasses.
- Cut, scrape and paint scattered woody weeds such as lantana and winter senna and exotic vines such as corky passionfruit.
- Spot spray and overspray throughout the western section to control exotic grasses and groundcovers weeds and smaller weeds including lantana.
- Cut, scrape and paint woody weeds such as lantana and winter senna and exotic vines such as corky passionfruit.
- Drill and inject scattered weed trees such as camphor laurel throughout the whole of the zone.
- Spot spray throughout the whole of the zone.
- Follow up at regular three to four monthly intervals.

Zone 17 Camphor

Location and extent

Zone 17 is located in the south west corner of the site adjacent to the southern boundary. The zone has been delineated and separated from Zone 19 as there is a stand of camphor laurel. Access to the zone is along the western boundary fence line adjacent to the cane paddocks.

The area of the zone is 1.88 ha.

Vegetation and habitat features

The vegetation is broad-leaved paperbark and swamp oak forest with an understorey of exotic grasses. There is a section of swamp oak and camphor laurel forest with dense mid stratum of camphor laurel.

Previous work

During the 2004-2006 works program camphor laurel was controlled within part of the zone. Primary work has not been completed throughout the whole zone and the 2004-2006 primary work will require follow up.

Threatened or significant species

No threatened or significant species have been recorded in this zone.

Management issues

Weeds include camphor laurel, lantana, winter senna, umbrella tree *Schefflera actinophylla*, tobacco bush in the mid stratum and blue billygoat weed, broad-leaved carpet grass, groundsel, cuphea, lantana, bahai grass, corky passionfruit, broad-leaved paspalum, umbrella tree and winter senna in the ground stratum.

Agricultural drainage infrastructure

A system of agricultural drains is located on the western edge of management Zones 17, 19 and 22. The western edge of these management zones has a boundary with a neighbouring property that is used for the production of sugar cane.

Management actions

- Commence work at the south east corner and work in an east to west direction moving north throughout the zone.
- Zone 17 provides the opportunity to trial the conversion of dense exotic grasses and groundcovers to native groundcovers.
- Spot spray throughout the zone controlling the broad-leaved paspalum and other groundcover weeds.
- Cut, scrape and paint all woody weeds including sections of dense camphor laurel and scattered lantana, groundsel, umbrella tree and winter senna.
- Drill and inject all larger camphor laurel and other large woody weeds.
- As the camphor laurel die the site will be open to light and a flush of weeds. Regular well timed follow up is essential once the camphor laurel have been injected. Spot spray throughout the site at one to three monthly intervals until broad-leaved paspalum and groundcover weeds are controlled.
- Follow up at regular three to four monthly intervals.
- The position of the boundary should be confirmed by survey undertaken by Council to determine extent of encroachment.

Additional information

Wild dog and fox have been recorded in this zone and on the adjoining cane land. There is an ongoing 1080 baiting program on adjacent cane land to control foxes, particularly throughout the bush stone-curlew breeding season. Fox dens have been recorded in this zone and fumigation undertaken. This zone should be investigated for active dens annually.

Location and extent

Zone 18 is located on Hovea Drive within the residential area with house lots on three sides. The zone has an area of 0.04 ha. The vegetation is regenerating rainforest.

Previous work

Dumped garden waste has been previously removed from in and around this zone. Primary work has been undertaken from 2012 to 2019.

Threatened or significant species**Green-leaved rose walnut *Endiandra muelleri* subsp. *bracteata***

A tree up to 30 m tall with brown bark, often in loose round plates, twigs and branchlets are covered in hairs. The moderately glossy leaves are oval or drawn out towards the tips, and measure 6-12 cm long and 3-5 cm wide, with three to five pairs of side veins. Flushes of new growth are pinkish-green. Flowers are small, yellowish and hairless, and are held in small clusters. The fleshy fruits are egg-shaped, 2.5-3 cm long and black when ripe.

Zone 18 (Lot 345 DP1049061) has been set aside to conserve a single specimen of green-leaved rose walnut which is endangered under the NSW TSC Act (1995). Thirteen additional specimens have been recorded at Koala Beach, one in Stage 5 and twelve specimens in Stage 7 (Benwell 2002).

Management issues

Weeds include giant devil's fig, tobacco bush, coastal morning glory and annuals. There is minimal weed remaining in the zone. Bush regenerators report dumped garden waste in this zone.

Management actions

- The green-leaved rose walnut is to be located and marked with flagging tape while bush regenerators are working within the zone.
- Hand weed within a 2 m perimeter of the green-leaved rose walnut.
- Spot spray throughout the remainder of the zone.
- Follow up on a regular basis at three to four monthly intervals.
- Monitor for garden waste dumping, clean up and report to Council as required.
- Monitor the zone to record recruitment of green-leaved rose walnut.
- Survey suitable habitat within the estate to confirm locations of previously identified green-leaved rose walnut, record additional individuals and identify areas for planting additional individuals.
- If space permits, plant an additional five green-leaved rose walnut using propagation material sourced from the estate. Otherwise, select locations elsewhere within suitable habitat on the estate.

Additional information

As recommended in the green-leaved rose walnut management plan (Benwell 2002) a paling fence has been constructed around the zone to discourage rubbish dumping into the zone.

A path to the plant was also recommended.

Related documents

- Management Plan for the Endangered Plant Rusty Green-leaved Rose Walnut (*Endiandra muelleri* subsp. *bracteata*), Koala Beach Stage 3 (Benwell 2002).



Plate 9 – View to eastern edge of Zone 18 from Hovea Drive

Location and extent

Zone 19 is the south west corner of Koala Beach. The zone has an area of 47.81 ha.

Vegetation and habitat features

The vegetation is dominated by broad-leaved paperbark and swamp oak. The structure is generally mid high to tall open forest, but in parts the canopy is more open. There are small numbers of camphor laurel in the upper stratum. The mid stratum is generally very sparse. The ground stratum is generally dense to sparse. With the exception of a few very low lying areas, the ground stratum is dominated by exotic species of grass, principally setaria and broad-leaved paspalum.

Previous works

No previous works.

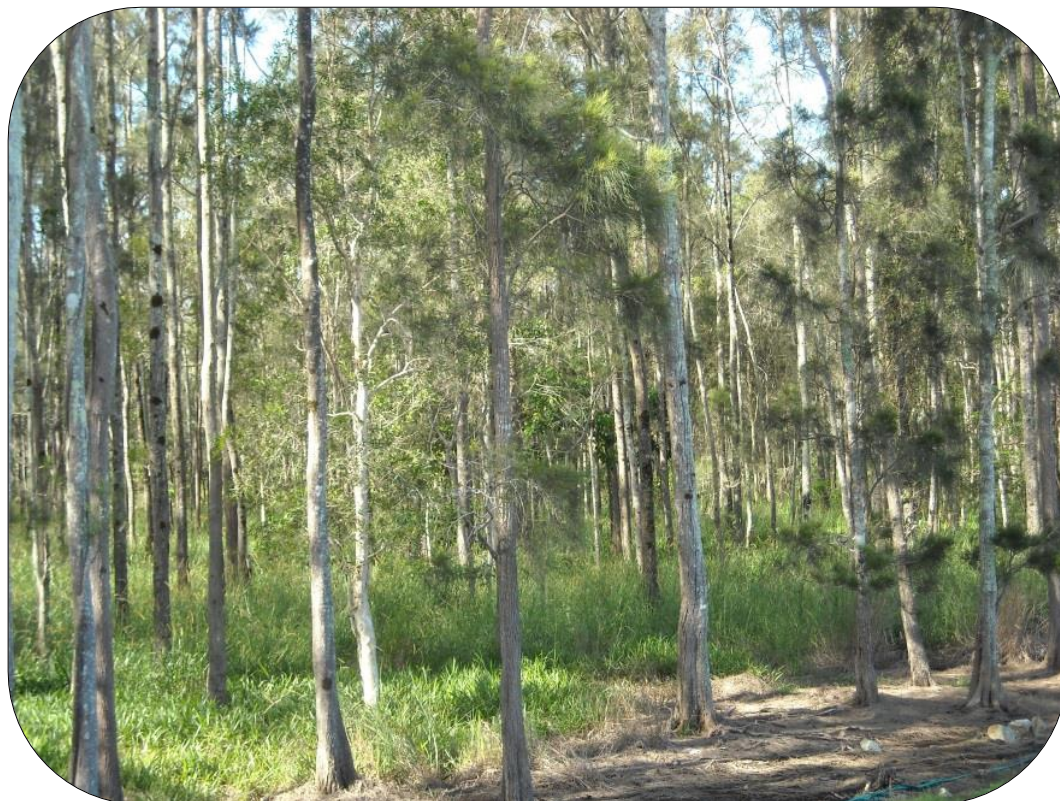


Plate 10 – Dense groundcover of exotic grasses in Zone 19

Threatened or significant species

Koalas are known from this zone. Black bittern has also been recorded here.

Coastal planigale monitoring works were initially undertaken in this zone but have been discontinued. It is thought that planigale are likely to avoid areas dominated by dense setaria and broad-leaved paspalum. See planigale monitoring reports for further information.

Management issues

Zone 19 is large and will be difficult to restore due to the dense groundcover of exotic grasses. Weeds include camphor laurel, lantana and tobacco bush in the mid stratum and setaria, broad-leaved carpet grass, camphor laurel, cuphea, lantana, vasey grass, broad-leaved paspalum and tobacco bush in the ground stratum.

Motorbikes have become more frequent in this zone, travelling to and from cane land to the west and along an informal track that travels along Christies Creek and through to Zones 12, 16, 21 and 20.

Management actions

The large size of the zone and the dense groundcover of exotic grasses throughout requires systematic control of the groundcover weeds, working through a section doing primary work and follow up before moving to the next section. A staged approach will gradually replace dense introduced grasses with native groundcovers.

- Commence work on the north east extending from the narrow boundary with Zone 12 and work along the western boundary of the residential area gradually extending to the west.
- Cut, scrape and paint woody weeds such as winter senna and lantana.
- Spot spray throughout the section to control the broad-leaved paspalum and other groundcover weeds.
- Follow up on a regular basis at three to four monthly intervals.
- Expand into the adjacent section as each section moves into maintenance.

Additional information

In the mid-1990s Zone 19 was relatively weed free, with the cover of weeds (exotic grasses) estimated at less than 20% over approximately 70% of the zone. Weeds were dominant in the ground stratum in only approximately 10% of the zone (Murray and James 1996) The ground stratum in the majority of this area is now dominated by weeds. Changes in drainage probably as a result of works undertaken on neighbouring properties are likely to have had a range of impacts on the function of the wetland, providing suitable conditions for establishment of exotic grasses and displacement of wetland sedges, grasses and herbs and tree death.

The formerly relatively weed-free section of zone 19 is mapped as Coastal Wetland under the SEPP (Coastal Management) 2018 and is zoned 7(a) Environmental Protection (Wetlands and Littoral Rainforests) under Tweed LEP 2000.

Related documents

- Koala Beach Habitat Restoration Plan, (BRS, revised 2009)
- Koala Beach Estate - Overall Management Guidelines (BRS, revised 2009)
- Planigale maculata Monitoring Reports, Koala Beach Estate (Hannah 2007, 2016, Hannah and Lollback 2020)



Plate 11 – Coastal planigale trap line in Zone 19

Zone 20 Water Tower to Cudgen Nature Reserve

Location and extent

Zone 20 is the large north western section of Koala Beach which links to Cudgen Nature Reserve on the northern boundary. The zone has an area of 66.16 hectares. The northern section of this zone was transferred to Cudgen Nature Reserve.

Vegetation and habitat features

The zone consists of a large number of vegetation communities as it is located on a mixture of hillside terrain and floodplain / sandplain.

The vegetation is in generally good condition with weeds concentrated in wet gullies, gaps in the forest and previously disturbed areas. The zone was previously classified as relatively weed free native forest.

The Tweed Vegetation Management Strategy (Kingston *et. al.* 2004) identifies the following vegetation communities:

- Coastal Blackbutt Open Forest to Woodland,
- Coastal Swamp Box Open Forest to Woodland,
- Blackbutt Open Forest Complex,
- Brush Box Open Forest,

- Broad-leaved Paperbark Closed Forest to Woodland,
- Broad-leaved Paperbark + Swamp She-oak Closed Forest to Woodland,
- Broad-leaved Paperbark + Eucalyptus spp. +/- Swamp Box Closed Forest to Woodland,
- Saltmarsh Communities, and
- Mangrove Open Forest to Woodland.

Previous works

Feral dog and fox control works (soft-jaw trapping, den searches and fumigation) have been previously undertaken in this work zone.

Threatened or significant species

Glossy black-cockatoos and koalas are known from this zone. Other threatened fauna species recorded here include common blossom-bat, little bent-wing bat and wompoo fruit dove *Ptilinopus magnificus*. The threatened plant species pink nodding orchid has also been recorded here.

Koala monitoring is undertaken in this zone.

Management issues

Weeds include lantana, bitou bush and corky passionflower in the mid stratum and setaria, vasey grass and broad-leaved paspalum in the ground stratum.

Motorbikes have become more frequent in this zone, travelling from cane land to the west and along an informal track that travels along Christies Creek and through to Zones 12, 16, 19 and 21. Such unauthorised land use results in new tracks, damage to vegetation and soils and potential damage to threatened plant communities, fauna habitat and Aboriginal Cultural Heritage sites.

Management actions

The large size of the zone and the scattered patches of weed will require systematic control of the weeds. Work through a section before moving to the next section to control the patches of weed.

- Commence work on the west adjacent to the water tower extending along the boundary with Zone 3.
- Target the locations where there are patches of weed.
- Cut, scrape and paint isolated larger woody weeds such as lantana and bitou bush or hand pull smaller plants.
- Spot spray patches of exotic grasses.
- Follow up on a regular basis at three to four monthly intervals.
- Expand into the adjacent section as each worked section moves into maintenance.

Zone 21

Burbi

Location and extent

Zone 21 was private land purchased by the NSW Department of Planning Industry and Environment (DPIE) and transferred to Tweed Shire Council in 2020. The zone has an area of 23.77ha. There is a koala research hub and associated koala food tree plantation which are excluded from the zone. The holding facility has an area of 1.65ha.

Vegetation and habitat features

The vegetation includes swamp oak forest, swamp oak / swamp mahogany forest and rainforest along the edges.

The rainforest pockets have been identified as roosting habitat for the common blossom-bat.

Previous works

No previous works in this zone.

Threatened or significant species

Two threatened flora species have been recorded in the rainforest, green-leaved rose walnut and white lace-flower *Archidendron hendersonii*.

Koalas and common blossom-bat are also known from this zone.

Coastal planigale monitoring works were initially undertaken in this zone but have been discontinued. Coastal planigale has been recorded in this zone.

Koala monitoring is undertaken in this zone.

Management issues

Weeds include areas of dense exotic grasses and lantana particularly along the forest edge with patches extending into the forest. Grasses include setaria, broad-leaved paspalum and broad-leaved carpet grass *Axonopus compressus*.

Management actions

The Plan of Management for the Environmental Protection Areas – Stage 7 (Callaghan et. al. 2003) provides details for restoration of the environmental protection areas within the zone for a three year period.

The Plan of Management also states that “on-ground restoration works to implement this PoM should be consistent with a detailed Overall Habitat Restoration Plan for the Koala Beach Estate.

The community Landcare group Friends of Cudgen Nature Reserve (FCNR) includes this zone in its regular work days and in 2019 secured a three year NSW Environment Trust grant to undertake koala habitat plantings over 1.2 ha, revegetate the dam to minimise cane toad breeding habitat and restore 7.9 ha of bushland in the zone. As part of the grant, FCNR prepared a restoration plan for the area funded by the Trust. FCNR delivers this grant with the support of Council and NSW NPWS.

- Restoration work to be consistent with the FCNR restoration plan.
- For areas not covered by the FCNR restoration plan, management actions are to be consistent with those identified for work zones 2 and 4 of that plan.
- Council continue to maintain tracks adjacent and within plantings in Zone 21.

Related documents

- Plan of Management for Land Zoned 7 (l) Environmental Protection (Habitat) and 7(a) Environmental Protection (Wetland and Littoral Rainforest) Koala Beach Stage 7, (Callaghan, et. al. 2003).
- *Planigale maculata* Monitoring Report, Koala Beach Estate Spring 2007 (Hannah 2007)
- Site Restoration Plan (Friends of Cudgen Nature Reserve 2019)

Zone 22

North

Location and extent

Zone 22 is located north west of Christies Creek has been transferred to Cudgen Nature Reserve. The zone has an area of 75.12 ha.

5.4 Plantings

Zones 24 - 26 Plantings

Location and extent

Zones 24 and 25 are plantings initially undertaken as partial compensation for the construction of the sports fields and road from Macadamia Drive to the sports fields. The zones have areas of 1.61 ha and 0.84 ha respectively. Additional community plantings in 2012 and 2013 extended Zone 24 to the west with a total of 1,400 trees being planted. The koala food tree plantings have been successful with trees now up to 12 m high in the older plantings.

Zone 26 (within Zone 21) includes a number of plantings at various stages. Combined the plantings have an area of 1.33 ha.

Vegetation and habitat features

Zones 24 and 26 are Koala food and habitat tree plantings and Zone 25 includes a mix of sclerophyll and riparian rainforest species. Tree species typically used in koala food and habitat plantings include forest red gum, swamp mahogany, tallowwood, small-fruited grey gum, broad-leaved paperbark, swamp box, swamp oak, willow bottlebrush and forest oak.

Previous work

Zones 24 & 25

These planting zones have had follow up weed control during 2010 to 2015. A community planting day was held in 2011 to enhance plantings in Zone 25.

Between 2011 and 2012 a further 600 koala food and habitat trees were planted here as part of Planet Ark's National Tree Day by Koala Beach residents. In 2013 a further 1,000 koala food and habitat trees were planted under a NSW Environmental Trust *Koala Connections* grant.

Zone 26

In 2018, 800 koala food and habitat trees were planted under the Federal Government's *Improving Your Local Parks and Environment* grant. A further 1,100 koala food and habitat trees were planted between 2018 and 2019 by FCNR and other community volunteers. Approximately 2,500 koala food and habitat trees and wetland plants have been planted under the FCNR Environmental Trust grant in 2019 and 2020.

Threatened or significant species

Koalas have been recorded in Zones 24, 25 and 26. Planted primary food tree species are being browsed by koalas.

Management issues

Plantings in the south had mesh fencing to control access and browsing by wallabies. Part of the fencing has been removed in Zone 24 to allow fauna, particularly koalas, access to the zones. The fencing has remained along the road frontage.

Management actions

- Revegetation areas will require a spot spray of exotic grasses and groundcovers every four months until the canopy starts to close. Exotic groundcovers will be gradually naturally replaced by native grasses and groundcovers and also shaded out by the plantings and natural regeneration.

- Council to undertake maintenance of tracks adjacent and within plantings in Zone 26.



Plate 12 – Planted trees well established and shading out weed regrowth in Zone 25

5.5 Arthraxon management area

Zone 23 Arthraxon Management Area

Location and extent

Zone 23 is the management area for the Threatened Hairy Joint Grass *Arthraxon hispidus* and is located west of Lomandra Avenue and surrounded by Zone 11. The core area is marked with pegs, and a surrounding buffer is managed with regular slashing, including a 5 m wide area along the edge of the forest on the west. The zone has an area of 0.39 ha.

Vegetation and habitat features

The core management area contains the population of Hairy Joint Grass, growing in competition with cuphea and exotic grasses. The surrounding buffer is mainly setaria with a cuphea understorey.

Previous works

Works have been undertaken in the zone for the past seven years being concentrated on the control of dense setaria and more recently cuphea.

Threatened or significant species

Hairy joint grass *Arthraxon hispidus*.

Management issues

The zone requires annual active maintenance in order to control weed species and to encourage persistence of hairy joint grass. The hairy joint grass germinates promptly with rain even in late winter.

Management actions

- Spot spray through core area in winter and before slashing, when hairy joint grass has died back and seeded.
- Slash core area when sprayed grass has died back. When slashed grass dries out rake into piles and remove from core area.
- Continue slashing of a buffer around the core area as part of the Koala Beach slashing program.

Related documents

- *Arthraxon hispidus* Population Plan of Management (2004)
- *Arthraxon hispidus* Summer 2008 Monitoring Report (Feb 2008)



Plate 13 (left) – *Arthraxon hispidus* reshooting (October) amid the weed cuphea and exotic grasses.

Plate 14 (below) – Arthraxon Management Area (long grass) and buffer after mowing.



5.6 Bushfire Asset Protection Zones

The following seven work zones are the combined responsibility of S&E and P&AC.

Zones 37 - 43 Asset Protection Zones

Location and extent

These zones are maintained by P&AC under the guidance of S&E and inspected on an annual basis, prior to the start of the bushfire danger period. APZ need to be maintained in accordance with the NSW Rural Fire Service standards for APZ. Maintenance is by slashing to reduce the ground fuel load within the APZ and vegetation/tree pruning and removal where required, particularly as trees grow and the canopy of trees begin to touch. Threatened or significant species Koalas, glossy black-cockatoos and bush stone-curlews are all known to utilise APZ, particularly where food trees occur within the APZ.

Koala monitoring is undertaken in Zone 40.

Management issues

Encroachment of private infrastructure by neighboring residents into APZs and dumping of garden waste from adjoining residential gardens.

Management actions

- The annual inspection of APZs should check that the APZs are not extending further than required or beyond the currently maintained area into the native vegetation. If required, stakes should be erected to mark the extent of the APZ.
- P&AC slashing contractors are to be briefed on the management of the zones and care is to be taken not to extend boundaries into native vegetation.
- Where tree removal is required to meet APZ standards, common tree species should be removed in preference to important habitat or food trees.

5.7 Parks and sports fields

The following nine zones are the responsibility of Parks and Active Communities (P&AC).

Zone 28 Dunghir Aboriginal Cultural Site

Location and extent

The zone has an area of 0.06 ha and is the location of a large Moreton Bay fig surrounded by mown grasses.

Previous works

The site is regularly maintained by P&AC.

Management issues

There are isolated weeds surrounding the base of the tree including ochna, ground asparagus and camphor laurel seedlings. These weeds should be spot sprayed ensuring not to damage any regenerating native seedlings.

Management actions

- Continue maintenance of zone by mowing and spot spray leaving a 5 m buffer around the base of the tree.
- Carefully spot spray to control weeds within the buffer to encourage germination of native seedlings.



Plate 15 – Large Moreton Bay fig in Zone 28 Dunghir

Zones 29 - 36

Gardens and playgrounds

Location and extent

These zones are either planted gardens or mown areas with playground equipment and shrub or tree plantings which are maintained by P&AC.

Threatened or significant species

Koalas have been observed using trees in parkland areas. Bush stone-curlews also utilise these areas.

Management actions required

- Garden plantings are to be local native species suitable for the location. Tree plantings in the larger parks, for example Zones 30 and 33, are to include habitat trees such as swamp mahogany, grey gum, forest oak and coast banksia.
- Care is to be taken when mowing, slashing or spraying adjacent to work zones managed by S&E. Zones 30, 32, 33 and 35 are adjacent to native vegetation. As these areas are regularly used by birds for nesting or shelter the boundaries to be clearly defined so that habitat along edges is not disturbed.
- Council is to investigate the placement of bollards where boundaries are not clearly defined.
- Care to be taken when maintaining garden plants. Garden plants are used by birds and other fauna. Consideration is to be given to timing of pruning when plants are not in flower, careful pruning of dominating native vines (e.g. monkey rope vine) and spraying of native groundcovers.

5.8 Sewage, drainage and infrastructure

The following six work zones are the responsibility of Council's Roads and Stormwater Unit (R&S).

Zones 44 - 49 Sewage/drainage/water infrastructure

Location and extent

Zones 44 and 45 are unlikely to have any impacts on habitat management as one is a pump station and the other is a reservoir.

Zones 46 to 49 are stormwater detention ponds and all adjoin native vegetation managed by S&E.

Vegetation and habitat features

The vegetation surrounding these man-made ponds was generally in poor condition requiring considerable work to provide habitat for native wildlife, and a barrier to prevent cane toads utilising the ponds as breeding hubs. Fencing, plantings and maintenance has significantly improved the habitat for native wildlife.

Previous works

Mown grasses immediately adjacent the ponds has been replaced by native vegetation. Plantings of native groundcovers has been undertaken since 2011. Works have focused on reducing the suitability of these sites for vertebrate pest species. The dense plantings of sedges and grasses around the ponds discourage cane toads.

The native vegetation surrounding the ponds has been maintained by bush regenerators commencing in 2014.



Plate 16 – Sediment pond in Zone 46 provides habitat for wildlife

Threatened or significant species

No threatened or significant species have been recorded in these zones.

Management issues

The sediment detention ponds and surrounding areas previously provided prime habitat for cane toads. Maintenance of vegetated buffers should continue to assist exclusion of cane toads.

Management actions

- Maintain plantings along edges which include *Lomandra* and native sedges and continue to encourage conditions that promote a dense margin to the water body.

6 Habitat restoration standards and procedures

Regeneration and restoration of native plant communities is acknowledged to be a complex, long-term process and more than just weed control or tree planting exercises. While weed control is of paramount importance, all weeds are seen as part of a dynamic, interacting ecosystem. By exploiting the natural regeneration potential of the native vegetation, weed species can be controlled in such a way that they are replaced by native species rather than by other weeds. This approach utilises the processes of natural regeneration and succession to ensure the long-term viability of the native flora and fauna communities (Joseph 2001).

The approach proposed in this plan is firmly based on the principle that effective and sustainable rehabilitation of native plant communities requires an integrated approach which takes into account a range of ecological factors and utilizes a variety of practical measures. Where a site has a variety of weeds an integrated approach contrasts with more traditional approaches based on weed control, which set priorities on a species by species level and selectively target individual species. If carried out in isolation from other ecological considerations, these approaches lead to increased re-infestation or to the replacement of targeted species with other weeds some of which may even be more damaging.

Restoration at Koala Beach requires assisted regeneration and reconstruction approaches. The assisted regeneration approach is appropriate in relatively intact plant communities where limited interventions such as weed control are sufficient to restore the native vegetation e.g. along the forest edges. The reconstruction approach is where revegetation techniques will be implemented e.g. planting of habitat trees for koalas or blossom-bats.

Weeds must be controlled in such a way that they are replaced by native species. Weed control in this context consists of several stages: (a) primary weed control (b) follow up weed control and (c) maintenance of the site.

6.1 Primary weed control

This involves initial weed control within a designated area and aims to destroy the parent weed seed source on the site.

The process of primary weed control requires accurate identification of all plant species and application of the appropriate control method for individual weed species. At Koala Beach it involves techniques such as spraying large areas of introduced grasses, cutting and painting or overspray of lantana or injection of large tobacco bush and winter senna.

On the other hand it may involve delicate hand removal of weed seedlings adjacent to native seedlings. Effective and accurate weed control at this stage is fundamental to successful restoration of plant communities.

6.2 Follow up control

Upon completion of primary weed control, resources for plant growth such as light, space, moisture and nutrients are made available to nearby plants and soil seed banks. Plants both native and weed will start regenerating and the aim is to remove the weeds at seedling stage so as to prevent their further spread. By controlling weeds before they flower and fruit also makes available the resources for native regenerating plants.

The follow up weed control generally involves spot spraying the emerging weed seedlings in the site after primary weed control. Accurate identification of all plants is vital at this stage as incorrect

identification can result in the destruction of native species and exhaustion of the native soil seed bank or the promotion of weed species if incorrectly identified as native species.

Follow-up weed control is essential to the long-term restoration of native vegetation. Regeneration of native species may be initiated but will be short-lived if weeds reclaim the site.

6.3 Maintenance

Timely site maintenance which involves frequent and regular spot spraying of weed species is required on a continued basis to ensure that weeds do not re-invade the site. Frequency and duration will vary according to the response of the native vegetation, viability of weed seed in the soil and the proximity of weed sources for re-infestation of the site.



Plate 17 – Drainage line managed by S&E as an extension of Zone 4. The vegetation is naturally regenerating native groundcovers and trees.

6.4 Planting

The following guidelines should be applied to any plantings undertaken as part of the restoration program.

- Restoration of original vegetation communities: revegetation should aim to restore the original pattern of vegetation types.
- Maintenance of genetic integrity: only local species provenances (i.e. from the Koala Beach site or nearby similar vegetation communities) should be used in planting and seeding treatments.

- Planting local native tree species in appropriate locations: this will progressively suppress exotic grasses and groundcovers and provide habitat for threatened fauna (e.g. tallwood *Eucalyptus microcorys*, small-fruited grey gum *E. propinqua*, grey ironbark *E. siderophloia*, brush box *Lophostemon confertus*, forest oak *Allocasuarina torulosa*, and coast banksia *Banksia integrifolia* in upland areas; swamp mahogany *E. robusta*, swamp turpentine *L. suaveolens*, swamp oak *Casuarina glauca*, broad-leaved paperbark *Melaleuca quinquenervia* in low-lying areas).
- Control of grazing by wallabies and hares can impact on the successful and quick establishment of native trees within Koala Beach. Consider protecting plantings with suitable tree-guards or fencing should there be evidence of grazing from wallabies or hares.

6.5 Threatened species

A Scientific Licence under the *NSW Biodiversity Conservation Act 2016* is required for any works in or near threatened species habitat or Endangered Ecological Communities.

As Endangered Ecological Communities and species listed as threatened in the *NSW Biodiversity Conservation Act (2016)* occur in Koala Beach a current Scientific Licence must be held by bush regenerators working on the site. Guidelines for Working in Threatened Species Habitat (Appendix 6) must be followed.

6.6 Cultural heritage

The *National Parks and Wildlife Act 1974* (NPW Act), administered by the NSW Department of Planning, Industry and Environment, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act provides specific protection for Aboriginal objects and places by making it an offense to ‘harm’ them. Harm includes to ‘destroy, deface or damage of an Aboriginal object or Aboriginal Place, and in relation to an object, move the object from the land on which it has been situated’.

In 2018, Tweed Shire Council adopted an Aboriginal Cultural Heritage Management Plan (ACHMP), with the development of this plan guided by a Memorandum of Understanding between Council and the Aboriginal community through the Tweed Aboriginal Advisory Committee. The ACHMP provides a thematic history and mapping of Aboriginal cultural heritage in Tweed Shire to assist property owners and developers understand the potential risk of harm to Aboriginal Cultural Heritage (ACH). The ACHMP outlines the actions and procedures required, consistent with legislative requirements, to avoid harm to ACH. Whilst this document focuses on development, it is of equal relevance to bush regeneration activities, particularly when ground disturbance is involved (i.e. tree planting), as these activities have the potential to cause harm to ACH.

The ACHMP includes mapping of both known and potential ACH, with members of the Aboriginal community openly sharing an appropriate level of their cultural knowledge to assist the wider community understanding their cultural heritage to ensure the protection of cultural heritage. The mapping associated with the ACHMP was developed through extensive consultation with the Tweed’s Aboriginal communities and has taken a landscape approach based on identified key criteria. Mapping has been defined into two layers; 1) Aboriginal place of heritage significance (known); and 2) Predictive Aboriginal cultural heritage. These are described below:

Aboriginal place of heritage significance

This layer provides spatial data and information of known ACH and may comprise tangible and intangible ACH as well as damaged and destroyed sites. The inclusion of damaged and destroyed

sites is in recognition of their significance to the Aboriginal people and recognition that they may also form part of a wider cultural landscape.

Predictive Aboriginal cultural heritage

The predictive mapping layer is developed on the high probability of ACH being present based on meeting a minimum of three of the ten landscape mapping criteria. This also reflects the landscape context.

For more information go to <https://www.tweed.nsw.gov.au/AboriginalCulturalHeritage>

A large area of the Koala Beach Estate, including built and bushland areas is an Aboriginal place of heritage significance.

The following procedure is to be followed for assisted regeneration and revegetation works at Koala Beach

1. All contracted bush regeneration staff are to be inducted into this procedure when working at the Koala Beach bushland estate.
2. For assisted regeneration work or revegetation work (with ground disturbance) in an area that is not mapped as an Aboriginal place of heritage significance, work can proceed with care. However if a bush regeneration contractor finds any suspected Aboriginal cultural heritage objects (i.e. shell midden material, stone artefacts, human remains) they must stop work in the vicinity of the Aboriginal cultural heritage object immediately. As it is an offence to harm an Aboriginal object or place under the NPW Act, an immediate stop work procedure will avoid harm to an Aboriginal object or place. The contractor is not to touch, handle or move the suspected Aboriginal cultural heritage object as this is defined as harm. A photograph of the suspected Aboriginal cultural heritage object and its location should be emailed to Tweed Byron Local Aboriginal Land Council's Cultural Heritage Unit culturalheritage@tblalc.com and the Council Project Officer managing the contract.
3. For proposed revegetation work (with ground disturbance) in an area that is mapped as a Aboriginal place of heritage significance, work cannot proceed until Council have undertaken the appropriate level of cultural heritage assessment.

6.7 Chemical use

Use of chemicals such as herbicides and their additives must only be carried out by personnel who hold current chemical users certificates.

These chemicals must be used in accordance with label directions unless an off-label use permit is procured from the APVMA (Australian Pesticides and Veterinary Medicines Authority). Chemical use records must also be kept for conditions, areas treated, amounts used and application rates in accordance with the *NSW Pesticides Act (1999)* (Use daily record sheet at Appendix 4).

Bush regenerators working on site are to comply with the Tweed Shire Council Pesticide Notification Plan and Chemical Sensitivity Register.

6.8 Work health & safety requirements

Contractors working on the site are required to comply with the requirements of the *NSW Workplace Health and Safety Act (2011)* and regulations.

The Act requires Job Safety Analysis (JSA) sheets to be compiled for work sites and to be read and signed by all site workers daily prior to commencement of work (Appendix 5). Any potential

hazards at work sites need to be assessed and steps taken to make the tasks as safe as reasonably practicable.

6.9 Personnel

Contractors implementing the plan are to be listed on Tweed Shire Council Panel of Providers for bush regenerators.

Contractors are to be fully qualified and experienced bush regenerators with a minimum of Conservation Land Management Certificate 3 or equivalent and two years' experience working in coastal sclerophyll, wetland and rainforest communities.

Supervising bush regenerators are to hold a minimum of Conservation Land Management Certificate 4 and four years' experience working in coastal sclerophyll, wetland and rainforest communities and the habitat of threatened flora and fauna.

Skills are to include a high level of plant identification particularly grasses and groundcover, native and exotic. The restoration challenge at many of the sites in Koala Beach is the control of exotic grasses and facilitating conversion to native grasses and groundcovers.

7 Street trees

In accordance with the Koala Beach Koala Plan of Management, street tree plantings throughout the estate include a specified number of primary koala food trees. Wherever possible these trees should be retained. Replacement of these trees is required when trees are removed due to safety issues, poor tree health or damage to infrastructure.

Street trees throughout the estate are maintained by P&AC, and any removal of koala food trees should be done in consultation with S&E, to determine appropriate replacement species and planting locations where required.

Any new street tree plantings are to be local native species, preferably preferred koala food trees. Where the position is unsuitable for a koala food tree then plantings should favour tree species that provide feed and shelter resources for native fauna.

Regular assessment should be undertaken to identify instances where problematic weed species have been planted on nature strips or adjacent to bushland. All identified occurrences need to be removed and replaced with suitable species.

8 Vertebrate pest management

There are a number of vertebrate pest animals known from Koala Beach Estate. These include wild dog, cane toad, fox, rabbit, hare, and common myna.

An extensive vertebrate pest management and monitoring program is carried out on an annual basis within and around Koala Beach. Management actions include remote camera monitoring, baiting, trapping, fox den searches and fumigation, cane toad musters, cane toad tadpole trapping, cane toad habitat modification, hare shooting.

9 Community involvement

Resident and landowner participation on the Koala Beach Wildlife and Habitat Management Committee is encouraged. The term of the committee is concurrent with the term of Council.

The primary objectives of the Committee are:

- To support the protection, restoration and management of the natural environment within the Koala Beach estate through contributing to prioritising the implementation of the wildlife and habitat management plans.
- To keep the residents of Koala Beach and the Tweed involved and informed about wildlife and habitat management and monitoring activities at Koala Beach.

10 Monitoring and evaluation

10.1 Monitoring

The purpose of regular monitoring, and reporting is (a) to track and document the progress of the project against its stated aims, (b) to provide feedback to the managers on the success or failure of the various management strategies and (c) allow adaptation of the restoration program to achieve best practice outcomes.

The following monitoring tasks are to be carried out:

1. Establishment of at least one photo point within each zone at the commencement of work. Photo points to be marked with a surveyors peg or star picket and marked with flagging tape and an identifying number. The star picket is to be located in the centre of the photo to provide a reference point. The coordinates of the photo point and direction of photo are to be recorded on the daily record sheet (DRS) or monitoring proforma. Additional photo points may be set up where there are particular points of interest e.g. dense weed, rubbish dumping or fauna habitat, or in large zones.
2. Repeat photos taken at each photo point at least annually. Additional photos may be taken to record particular progress or issues.
3. Completion of the monitoring proforma (Appendix 7) for each zone at commencement of work and again at the completion of work or prior to annual reporting, whichever comes first. If work within a zone is ongoing over a number of years, then annual completion of the proforma is sufficient.
4. Completion of daily record sheets (Appendix 4).

10.2 Performance indicators

The following performance indicators will be used to track progress over time and determine the success of the project on an annual basis. The timeframe for measurement against each performance indicator is the timeframe between starting work in a zone (or continuing maintenance in a zone) and the end of the annual reporting period. The following measures are collected via the monitoring proforma (Appendix 7) and assessed for each zone.

1. No increase in percentage cover of exotic plant species in each stratum.
2. Maintenance or increase in percentage cover of native plant species in each stratum.
3. No increase in number of dominant weed species in each stratum.
4. No increase in percentage cover of dominant weeds in each stratum.
5. No increase in weed density or severity scores.

6. Nil fruiting and no mature individual weed species present.
7. No increase in total threat score.

10.3 Reporting

1. A six-monthly meeting will be held with Council officers to review the progress of the project, discuss effectiveness of management actions and identify any emerging management issues.
2. An annual report is to be compiled and submitted to Council and will include the following as a minimum.
 - A summary of works completed in each work zone including a map and hectares of area worked.
 - All monitoring results and evaluation against performance indicators for each zone.
 - Photo-point locations and photos.
 - Any deviation from the management plan or any works contract as a result of adaptive management.
 - Identification of any ongoing management issues requiring attention by Council.
 - Any records (coordinates) of threatened flora and fauna species.
 - Recommendations regarding the ongoing management of the site.
 - Submission of daily record sheets.

10.4 Adaptive management

The management actions recommended in this plan are intended to provide a basis for the success of the project. A key factor for success will be the ability of those implementing the plan to respond to changing site conditions. The purpose of regular monitoring, recording and reporting is not just to document the progress of the project, but also to respond to unanticipated circumstances, provide feedback to the managers on the success or failure of the various management strategies and allow adaptation of the rehabilitation techniques and implementation schedule to achieve maximum effectiveness in weed control and habitat management.

This adaptive management approach is especially important in relation to the control of weeds and where applicable the species selection for planting programs. Regular monitoring is to be used to assess the effectiveness of management strategies and provide the basis for adaptation of the implementation schedule.

Any recommendations for amendment of this plan will be discussed with Council.

11 References and further reading

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Appendix 1 – Work zone areas

Work zone	Zone name	Area (hectares)
1	Common Blossom-bat Reserve	1.35
2	Glossy Black-Cockatoo	1.87
3	Muskheart	6.39
4	Upper Grey Gum Gully	0.75
5	Lower Grey Gum Gully	2.75
6	Entrance North	8.67
7	Entrance South	4.40
8	Macadamia South	7.64
9	Sports Fields North	9.05
10	Creek	4.65
11	Macadamia West	2.53
12	The Tongue	5.42
13	Dunghir Aboriginal Site	1.76
14	Compensation	2.62
16	Christies	9.04
17	Camphor	1.88
18	Endiandra Reserve	0.04
19	Grassy	47.81
20	Burbi	66.16
21	North	23.77
23	Arthraxon Management Area	0.39
24	Plantings	1.61
25	Plantings	0.84
26	Plantings Lot 919 and Burbi	1.33
28	Dunghir Aboriginal Site	0.06
29	Gardens and Playgrounds	0.04
30	Gardens and Playgrounds	0.29
31	Gardens and Playgrounds	0.46
32	Gardens and Playgrounds	0.64
33	Gardens and Playgrounds	0.33
34	Gardens and Playgrounds	0.28
35	Gardens and Playgrounds	0.65
36	Gardens and Playgrounds	2.44
37	Asset Protection Zone	1.04
38	Asset Protection Zone	1.09
39	Asset Protection Zone	0.84
40	Asset Protection Zone	1.09
41	Asset Protection Zone	0.71
42	Asset Protection Zone	1.07
43	Asset Protection Zone	0.74
44	Infrastructure	0.03
45	Infrastructure	0.18
46	Infrastructure	0.66
47	Infrastructure	0.31
48	Infrastructure	0.32
49	Infrastructure	2.77
Total		228.76

Appendix 2 – Weed list

Scientific name	Common name
<i>Ageratina adenophora</i>	Crofton weed
<i>Ageratina riparia</i>	Mistflower
<i>Ageratum houstonianum</i>	Blue billygoat weed
<i>Andropogon virginicus</i>	Whisky grass
<i>Asclepias curavassica</i>	Blood flower
<i>Aster subulatus</i>	Wild aster
<i>Axonopus compressus</i>	Broad-leaved carpet grass
<i>Baccharis halimifolia</i>	Groundsel
<i>Chloris gayana</i>	Rhodes grass
<i>Cinnamomum camphora</i>	Camphor laurel
<i>Cirsium vulgare</i>	Spear thistle
<i>Conyza bonariensis</i>	Flaxleaf fleabane
<i>Cuphea carthagenensis</i>	Cuphea
<i>Drymaria cordata</i> subsp. <i>diandra</i>	Tropical chickweed
<i>Echinochloa crus-galli</i>	Barnyard grass
<i>Erechtites valerianifolia</i>	Brazilian fireweed
<i>Gnaphalium</i> sp	A cudweed
<i>Gomphocarpus fruticosus</i>	Narrow-leaved cotton bush
<i>Hydrocotyle bonariensis</i>	A pennywort
<i>Hyparrhenia hirta</i>	Coolatai grass
<i>Hypochaeris radicata</i>	Cat's ear
<i>Ipomoea cairica</i>	Coast morning glory
<i>Lantana camara</i>	Lantana
<i>Melinis minutiflora</i>	Molasses grass
<i>Passiflora edulis</i>	Common passionfruit
<i>Passiflora suberosa</i>	Corky passionfruit
<i>Passiflora subpeltata</i>	White passionflower
<i>Paspalum conjugatum</i>	Sour grass
<i>Paspalum notatum</i>	Bahai grass
<i>Paspalum urvillei</i>	Vasey grass
<i>Paspalum wettsteinii</i>	Broad-leaved paspalum
<i>Pennisetum clandestinum</i>	Kikuyu
<i>Phytolacca octandra</i>	Inkweed
<i>Schefflera actinophylla</i>	Umbrella tree
<i>Senecio madagascariensis</i>	Fireweed
<i>Senna pendula</i> var <i>glabrata</i>	Winter senna
<i>Setaria sphacelata</i>	South African pigeon grass
<i>Sida rhombifolia</i>	Paddy's lucerne
<i>Solanum capsicoides</i>	Devil's apple
<i>Solanum chrysotrichum</i>	Giant devil's fig
<i>Solanum pseudocapsicum</i>	Jerusalem cherry
<i>Soliva sessilis</i>	Bindyi
<i>Trifolium repens</i>	White clover
<i>Urena lobatus</i>	Urena
<i>Urochloa mutica</i>	Para grass

Appendix 3 – Weed control methods

(Adapted from Joseph 2001)

"Cut-scrape-paint" method This method applies to all woody shrubs, trees and some vines.

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

Note: Where practicable, all seed which has high viability and longevity should be removed from the parent and either composted on site or removed from the site, e.g. Senna spp.

Stem injection: This method applies to all woody trees and shrubs.

- (a) With a 10mm drill make a hole, at a slight angle, into the trunk. (Note: it is important not to make drill hole too deep).
- (b) Apply herbicide immediately into the hole using a tree injecting device (if using glyphosate, apply at the rate of 1 : 1.5).
- (c) Repeat this procedure in 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 hole above it. (Note: two rows will be sufficient for trees with trunks of 6-10 cms.; larger trunk diameters will need correspondingly more).
- (d) Treat all visible lateral roots as per (a).

Spot spraying: This is carried out using a 15 litre back-pack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used, with the addition of the red marker dye. For plants which show some resistance to herbicides e.g. Glory Lily, or when growing conditions are not optimal, an acidifying agent L.I. 700® or sticker Protec® is also added. Recently it has been observed that a mixture of glyphosate and Metsulphuron methyl has produced promising results for plants that are difficult to control with glyphosate alone (Note: an appropriate permit is required for this 'off-label' herbicide usage).

Overspray: This method is applicable to large, dense infestations of such plants as Bitou Bush and Lantana where it is desirable to leave the dead plants intact to prevent erosion and over-exposure of large areas, to protect native seedlings from predators such as wallabies and to 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: For Lantana, the usual dilution rate is glyphosate 1 : 100 water; for Bitou Bush glyphosate 1 : 150 - 1 : 300 water. Weaker solutions are most effective in the winter months.

Alternatively, weeds can be cut and flattened with brush-hooks or loppers and the subsequent regrowth sprayed with glyphosate.

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. Asparagus spp. 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.

Hand pull: Gently pull seedling out by the roots, wiggling the plant to fully free them.

Appendix 4 – Daily record sheet

Site name / location			Date			Time start / finish			
Team members – all staff have Workplace Health and Safety Induction for work activities and specific site requirements prior to entering site Names:									
WHS – Take 5 for safety – Stop and think through the task									
Is there a procedure for the task (SOP, SWMS, JSEA)? Y / N		Are there any changes to a process / procedure? Y / N		Do we have correct equipment and PPE for the task? Y / N		Are we trained, competent and authorised for the task? Y / N		Do we have a clear plan in mind? Y / N	What is this site's emergency plan?
Hazard / Injury / Incident / Near miss Report Activated Y / N				Summary of Incident:					
Growing conditions		Temperature / Humidity °C / %		Weather Conditions			Wind Direction / Speed		
Work Zone / Location		Hours	Work Details / Weeds Treated					Treatment Method	
Chemicals Used / Rates / Totals		Notes / Comments / Threatened Species / Fauna							
Equipment Used	Glyph	Metso	Dye	Pulse	Other	Water	Number mixed		
Backpacks									
Applicator									
Injector									
Daily Chemical Totals	ml	g	ml	ml					

Add map of work area


Appendix 5 – Job safety analysis

Sample risk assessment form

HAZARD IDENTIFIED	RISK RATING	CONTROL MEASURE	NEW RISK RATING
Traffic hazard Working in close proximity to roads		<input type="checkbox"/> Use traffic controller <input type="checkbox"/> Use of safety signs <input type="checkbox"/> Use of woggles hats or temporary barrier <input type="checkbox"/> High visibility clothing	
Sun exposure Hot conditions		<input type="checkbox"/> Reduce exposure time – rest breaks <input type="checkbox"/> Provide ample water <input type="checkbox"/> Protective clothing and sunscreen	
Working with chemicals		<input type="checkbox"/> Current MSDS held <input type="checkbox"/> Adequate washing facilities <input type="checkbox"/> Hazardous substances stored and labelled correctly <input type="checkbox"/> Use of personal protective clothing <input type="checkbox"/> Rotate tasks to avoid prolonged exposure	
Biological hazard Needle stick injury		<input type="checkbox"/> Inspect site before work commences <input type="checkbox"/> Provide appropriate waste disposal container <input type="checkbox"/> Personal protective equipment	
Manual handling Handling heavy objects		<input type="checkbox"/> Use correct lifting and carrying techniques <input type="checkbox"/> Use lifting aids <input type="checkbox"/> Use wheelbarrow etc. wherever possible <input type="checkbox"/> Ensure clear area before lifting <input type="checkbox"/> Share the load <input type="checkbox"/> Rotate activities or rest breaks <input type="checkbox"/> Appropriate personal protective clothing	
Crush impact Cut, crush and impact		<input type="checkbox"/> Knowledge and correct use of tools <input type="checkbox"/> Appropriate personal protective clothing <input type="checkbox"/> Correct tool for job	
Slips, trips and falls		<input type="checkbox"/> Avoid carrying awkward or heavy objects on uneven ground <input type="checkbox"/> Remove all potential hazards if possible or mark with coloured tape <input type="checkbox"/> Do not leave tools lying in pathways <input type="checkbox"/> Do not run <input type="checkbox"/> Ensure boots are firmly laced	

Hazardous plants Plants that may cause allergic reaction		<input type="checkbox"/> Identify plants which may cause allergic reactions <input type="checkbox"/> Mark area with coloured tape <input type="checkbox"/> Wear appropriate personal protective equipment	
Bites and stings		<input type="checkbox"/> Create disturbance on site before beginning work <input type="checkbox"/> Apply insect repellent <input type="checkbox"/> Wear appropriate personal protective equipment	

Sample risk assessment matrix

How severely could it hurt someone OR how ill could it make someone	Very likely could happen anytime	Likely could happen sometime	Unlikely could happen, but very rarely	Very unlikely could happen, but probably never will
 Kill or cause permanent disability or ill health	1	1	2	3
Long term illness or serious injury	1	2	3	4
Medical attention and several days off work	2	3	4	5
 First aid needed	3	4	5	6

Appendix 6 – NPWS checklist for bush regeneration in threatened species habitat or an endangered ecological community

The following guidelines are derived from the relevant sections of NPWS Draft Checklist for Bush Regeneration Activities in the Habitat of Threatened Species, Endangered Populations and Endangered Ecological Communities.

Management Planning:	yes	no	more info attached
The proposed activities will be in accordance with a management plan or site plan (map). Please attach the plan or relevant sections of the plan or strategy to the licence application.			
The project has been discussed with the relevant Landcare coordinator. If not, provide details of any other professional advice you have sought, e.g. from a qualified bush regenerator.			
A NPWS Wildlife Atlas database search of a 5km radius of the site has been undertaken to identify threatened flora/fauna species known or likely to occur on the site.			
Prior to commencing any works on site, a permit or permission will be obtained from the relevant landowner(s) or land manager(s).			
Training and supervision:	yes	no	more info attached
All activities by workers will be regularly checked and approved by the co-ordinator.			
All workers will be informed of any threatened species or endangered ecological communities known from the area or which may occur in the area and the potential impacts of activities on these species/communities e.g. vines on the edge of a littoral rainforest remnant may protect the remnant from salt-bearing winds.			
All workers have adequate weed and native plant identification skills i.e. all workers can identify and differentiate between weeds and native plants that occur on the site.			
Workers will be familiar with the identifying features of threatened flora that are known or likely to occur in the project area. Where threatened species known from the area are similar to weed species, the distinguishing features between these will be understood prior to commencing the work.			
Access to site:	yes	no	more info attached
All vehicular access to the site will be restricted to formed roads.			

Unnecessary damage to sites will be avoided e.g. avoid working in wet weather to lessen soil compaction.			
To reduce the possibility of introducing plant diseases and weeds the following measures will be applied: (1) Secateurs will be sharp and cleaned with methylated spirits; and (2) Footwear will be cleaned of loose soil and preferably treated with bleach between sites.			
Impacts on flora:	yes	no	more info attached
Prior to any works being undertaken, the presence or absence of threatened flora will be determined by a thorough walking search of the area.			
All threatened flora will be tagged with highly visible flagging tape before work commences. If a number of individuals occur in a clump, the area should be marked out with flagging tape.			
Cutting or damaging of threatened flora will be avoided.			
All plants will be positively identified before they are removed (pulled, cut, poisoned etc.).			
Weed removal within two metres of a threatened species will be undertaken by hand.			
Impacts on fauna:	yes	no	more info attached
All workers will be aware of any threatened fauna that are known or likely to occur on site, and the potential impacts of the proposed activities on those species.			
The habitat and refuge potential of weeds and rubbish will be considered prior to removal e.g. lantana can provide cover for threatened fauna such as the pale-vented bush-hen. Dead lantana and poisoned camphor laurel should, where possible, be left in situ.			
Weeds will be removed gradually in areas where an infestation is extensive. Ideally, 50% of weeds that may provide habitat should be left until native plant species have re-established and provide alternative refuge.			
Disturbance to, and removal of rocks, logs and other potential refuge sites will be avoided.			
A herbicide registered for use near waterways will be used within five metres of waterways.			
Herbicide spraying will be restricted to a distance greater than five metres from watercourses where threatened frogs are known or likely to occur and within a ten metre radius of records of threatened frogs.			
A buffer of one metre along other watercourses will be maintained in which no herbicide will be sprayed.			

Care will be taken to minimise disturbance to shy or cryptic species e.g. the Marbled Frogmouth roosts in vine 'curtains'.			
Care will be taken to minimise disturbance to the leaf litter layer.			
Reconstruction through revegetation: (Note - this section does not address propagation or planting of threatened species. This activity would need to be separately addressed).	yes	no	more info attached
Seed collection or cuttings will be from species, populations or ecological communities other than those listed as threatened (unless licensed)			
Prior to collecting any seed or cuttings permission will be obtained from the relevant landholder or manager of the site e.g. a licence is required to collect native plants on National Parks estate.			
Seed collection from any one species will be limited to less than 10% of the available crop at that site.			
Seed collection from any individual plant will be limited to less than 10% of the available crop.			
If your seed source is used by other seed collectors, has consideration been given to minimising any cumulative impacts to the source plants? Some individual plants are known as a reliable seed source and their seed is collected extensively. This may result in – (1) a reduction in genetic diversity); and (2) an impediment to the individual's natural ability to regenerate.			
When collecting propagation material from a wild population, collection will be random from as many individuals as possible across the population to ensure a representative range of genetic material is collected. Collectors will avoid selection of propagation material on the basis of physical attributes e.g. tallest, most attractive, greatest amount of seed or flowers.			
Plantings will be sourced from stock of local provenance.*			
Will propagated material collected only be used at the subject site? I.e. excess material will only be used at other sites if it meets the provenance criteria.			
(Plants are likely to be purchased from reputable commercial nurseries – appropriate seed collecting techniques assumed)			
A buffer of five metres will be maintained around all threatened plant specimens. Planting will only be undertaken outside this buffer. This requirement is intended to protect the roots of the threatened plant from damage or introduction of disease.			
Care will be taken to ensure that mulch does not introduce weeds or impede natural regeneration at the site.			
Care will be taken to ensure that weeds and/or <i>Phytophthora cinnamomi</i> are not introduced to a site from pots of cultivated plants.			

Consideration will be given to the possible impacts of plantings on the ecological requirements of threatened species at the site e.g. reduced light, competition, etc.			
Species will be planted within their natural habitat and range. Plantings will be guided by the plants' local habitat preferences e.g. the species used for plantings along watercourses should be those that naturally occur in that habitat in your local area.			
Herbicide use: (Note - A permit from the National Registration Authority for Agricultural and Veterinary Chemicals PO Box E240, Kingston ACT 2604 may be required for herbicide use that is not consistent with conditions specified on the label).	yes	no	more info attached
A buffer of two metres will be maintained around all threatened plant specimens. Herbicide use will only be undertaken outside this buffer.			
Herbicide use will cease where there are any signs of threatened species being affected by herbicide e.g. browning off, wilting or deformed growth.			
All herbicide spray operators will be capable of undertaking precise and effective weed control.			
Spray will be directed away from threatened flora.			
Herbicide will only be sprayed in suitable weather conditions when the impact of spray drift (windy) or run-off (wet) on threatened flora is minimised.			
Marker dyes e.g. white field marker' will be mixed with herbicide before use. Marker dye enables the worker to see where the spray is landing.			
Reporting and data records:	yes	no	more info attached
Any new records of threatened species will be provided within three months to NPWS. These records will be in a format appropriate for entry into the Wildlife Atlas, once identification of a threatened species is confirmed by a recognised authority.			

*Local provenance species should be regarded as those species propagated from material that has been collected from a natural wild population as close as possible to a site. For example, within the local catchment which may be based on a local creek.

Appendix 7 – Monitoring proforma

A guide to completing this form is included in the appendices of the Bush Futures SAP guidelines. This form should be completed for **each zone**. Assessment should be made of the zone as a whole. A form must be completed before works begin, and again annually and/or on completion of work.

Given limited time in the field and the subjective/qualitative nature of rapid assessment, estimating many of the environmental variables listed here is difficult. Professional judgement and discretion will be required to deduce normal limits.

ZONE DETAILS			
Date		Observer	
Site name		Site location	
Zone name & number		Area (worked or to be worked)	
Restoration phase*	<i>eg. Prior to primary work, completion of primary work, completion of 2021 maintenance etc</i>		

DOMINANT VEGETATION COMMUNITY			
Vegetation Description			
Dominant species canopy			
Dominant species mid			
Dominant species ground			
Comments	<i>eg. threatened species observations, EECs, variations in veg types and location</i>		

HABITAT FEATURES			
Feature	Score (0-3)	Feature	Score (0-3)
Hollows (> 5 cm)		Glossy Black-Cockatoo feed tree	
Fallen logs		Koala feed tree	
Native Grass/Reed/Sedge		Blossom-bat feed tree	
Riparian/wetland		Flying-fox camp	
Gullies		Other	
Rock/boulders			
Cave/overhangs			
Score: 3 = abundant , 2 = common, 1 = few, 0 = absent			

STRUCTURAL AND COMPOSITIONAL INTEGRITY

Stratum	Height range (m)	% Cover			Disturbance type	Structural feature	Score (1-4)
		Native	Exotic	Total			
Emergent						Native species composition	
Canopy						Age class diversity	
Mid						Canopy spp. recruitment	
Ground						Growth stage	

Native species composition score: A measure of whether a normal range of species are regenerating on site or whether fewer species are emerging than expected (for example, same species cohorts).
1 = fewer than expected native species, **2** = normal range of native species for the vegetation community
Age class diversity scores: A measure of the spread of sizes of trees, shrubs and other vegetation.
1 = diminished range of age classes across all strata, **2** = normal range of age classes across all strata
Canopy spp. recruitment scores: a measure of the extent to which canopy species are regenerating
1 = recruitment of fewer canopy spp. than expected, **2** = canopy spp. regenerating and common
Growth stage scores: **1** = early successional, **2** = advanced re-growth stage, **3** = mature, **4** = old growth (rare)

DOMINANT WEED ASSESSMENT (% COVER)

Species	Canopy	Mid	Ground
Weed total score (DxS) =			

Weed density score (D) =	
1 = Few or no weeds observed (no or light infestation). 2 = Weeds mainly on edges/very scattered (light to moderate) 3 = Weeds common, but patchy or scattered (including canopy) 4 = Weeds throughout excluding canopy (heavy infestation) 5 = Weeds throughout including the canopy (heavy infestation)	
Weed severity score (S) =	
1 = Few or no problem weeds present 2 = Some problem weeds present (moderate) 3 = Many problem weeds present (severe)	

OTHER WEEDS

THREATS		
Threat	Score (0-3)	Management notes
Erosion		
Grazing		
Pests		
Structural Works		
Dumping		
Inappropriate fire regime		
Vehicles		
Clearing		
Underscrubbing		
Adjacent land use		
Other		
Total score		

FENCING (if applicable)		
Fence type	Length	Cost
Fencing notes:		

PHOTO POINTS				
Photo point No.	Description	Direction	GPS co-ordinates	
			Easting	Northing