Emigrant Creek

Riverbank Stabilisation and Rehabilitation

Bushland Restoration Services

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Cover photograph: *Remnant rainforest on southern bank of Emigrant Creek*

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This report is prepared with information supplied by the client and on information obtained using accepted survey and assessment methodology as described in the report

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1 Introduction and Background

Bushland Restoration Services was contracted by Ballina Shire Council to prepare a Vegetation Management Plan for Emigrant Creek.

The subject site is located on public lands between Old Bangalow Road and Emigrant Creek from the intersection with Tamarind Drive to the village area of Tintenbar and on the western side of the creek between Crosby's Lane and Emigrant Creek. The subject site has approximately 3km of riparian frontage to Emigrant Creek.

The primary objectives of the project identified in the brief to prepare the VMP are;

- guide primary and secondary weeding of the locations as shown in Attachment 1 (**See Figure 1**),
- provide a template for revegetating the banks along the length of the creek as shown in Attachment 1 (**See Figure 1**).

The project required Ballina Shire Council to prepare a Review of Environmental Factors (REF) (October 2018). The objectives of the works proposed in the REF are;

- To stabilise and revegetate approximately 53,700 m2 of the riverbank of Emigrant Creek
- Improve water quality within Emigrant Creek
- Provide additional terrestrial and aquatic habitat for native fauna
- Comply with environmental legislation
- Avoid any impact on any area of Aboriginal or heritage significance
- Avoid disturbance of acid sulfate soils (ASS)
- Apply current best practice for bush regeneration in riparian locations.

2 Site Description

The mapping prepared by Ballina Shire Councils divides the site into six work areas. These work areas have been adopted as work zones for implementation of this Plan. **See Figure 1**.

The REF (2018) provides a detailed description of the existing environment and its management.

2.1 Tenure

The eastern and northern banks of Emigrant Creek within the work zones are in public ownership, although liaison with a private landholder will be required in one location for access to the creekbank.

The west bank between the creek and Crosbys Lane and its unformed extension is also in public ownership, as part of the road reserve. The extension of the south bank from the project area to Tamarind Drive is in private ownership.

2.2 Access

Access to the west bank is from Crosbys Lane. The road is narrow and parking is restricted. There is minimal traffic using the road. The east bank is accessed from George Street and Old Bangalow Road. The two northern zones have space for parking to access the work areas. The central zone has restricted access as there is private property between the road and the work zone. There is access from the zone to the north. The most eastern zone has easy access from Old Bangalow Road. Parking is restricted. The lower bank of the work areas can be accessed by boat from the creek on low tide. See Traffic Plan for Old Bangalow Road **Appendix 5.**

Figure 1 Emigrant Creek Riparian Zones

2.3 Soils

Morand (1994) describes the soils as Krasnozems forming on basalt derive from alluvium being quite uniform in their grain size along the vertical depth being often deep up to 150cm. “As they are floodplain soils, they are susceptible to slumping, waterlogging, erosion and are located in an area of high flood hazard”, “planting of native riparian trees is encouraged” and “woody weeds (i.e. camphor laurel and coral tree) are prolific along stream banks” Morand 1994.

Morand (1994) mentions acid soils on the floodplain. The REF (2018) Section 5.1 addresses the potential for acid sulfate soils and has undertaken sampling. The REF (2018) states “the results show that at 1 metre below ground level the acid sulfate soils will require management if disturbed…. the results also show the soil at all levels are quite acidic so liming and mulching may be required when planting to assist with the survival and establishment of the revegetation works”.

2.4 Flooding

“The site is identified as being in the extreme category for Flood Hazard under the Ballina Development Control Plan (2012), in the lower reaches and as being at risk from flooding in the upper reaches” ….” This has little impact on the proposed works, apart from possibly requiring replanting after a high flow event” REF 2018.

There are nineteen culverts or open drains located within the work zones. **See Figures 2 – 4**.

Plate 1 High tide Old Bangalow Road east - February 2019

2 Community Consultation

Landholders with properties on Emigrant Creek were contacted by Ballina Shire Council to notify them of the preparation of a Plan.

Six listed interested neighbours were contacted by BRS by phone or email. Four of the neighbours met with BRS in early January and discussed the proposed restoration of Emigrant Creek. These neighbours agreed to inform two additional neighbours who were unable to attend the meeting.

All were supportive of the restoration including control of weeds and plantings of native species. There were no issues with chemical use as long as signs were erected prior to and during weed control. When chemical control proposed next to a residence the resident to be given prior notice, not just a sign placed on the day.

They supported the use of machinery such as a slasher to reduce dense weed such as the area on Crosbys Lane and along the edge of the vacant lot south of the Medical Centre. Council had previously used machinery to remove dense week on Old Bangalow Reserve "The Common" and the residents were supportive of this action. Residents had an interest in The Common and suggested, resurface and grass, bollards and a chain gate be installed, the creation of a low key picnic area with a table and seats and shade trees planted. There were concerns in relation to activities such as rubbish dumping and vehicle access.

The residents supported the removal of Camphor Laurel *Cinnamomum camphora* from the creek as they considered that the fallen trees had caused the undercutting of banks and the formation of a backwater encouraging mosquitoes to breed. The trees also restricted access for recreational water craft.

The residents stated that Emigrant Creek was in a worse condition closer to the villages as there were no water plants and Carp had replaced Bass and Perch.

The neighbour next to the bus turning circle was concerned that the house would be exposed after weed removal. This property was re-visited, and staged removal of the weedy vegetation is recommended commencing along the boundary with the private property and planting a dense barrier of native shrubs such as Lilly Pillies to screen the house.

The landholders to the south of Emigrant Creek were consulted and have been actively controlling weeds on their property. They would like to be involved in a project to rehabilitate their creek bank should the opportunity arise. They would like further information on management of their property.

3 Site Assessment

The site was assessed in January and February 2019 along the upper banks adjacent to Old Bangalow Road and Crosbys Lane and the lower bank from a boat in Emigrant Creek.

Native and weed species were recorded and the dominant species recorded for each zone. The lower bank was generally a mix of Typha *Typha* sp, Taro *Calocasia esculenta* and Para Grass *Urochloa mutica*. Other occurrences of dense weed such as Butterfly Bush *Buddleji madagascarensis* or Canna Lilly *Canna indica* were recorded. The upper bank had Camphor Laurel and Coral Tree *Erythrina crista-galli* and *E. x sykseii* occurring as single trees or a clump with exotic grasses such as Para Grass, Setaria *Setaria spachelata* and Broad-leaved Paspalum *Paspalum mandiocarnum* as groundcover.

Native rainforest species were recorded within the clumps of Camphor Laurel. Closer to the village of Tintenbar the shrubby woody weeds increased in the understorey and included Lady of the Night, Small-leaved and Large – leaved Privet, *Ipomoea* sp and Lantana.

4 Restoration

The highly degraded and modified site has no remaining remnant vegetation dominated by native species. Historically the site was cleared and grazed. It is likely that the vegetation was riparian lowland subtropical rainforest and swamp sclerophyll vegetation communities.

The southern side of Emigrant Creek is private property in the ownership of a single landholder. There are two riparian remnants on the property that can be used as a reference for selection of species for planting in the project area. The remnants although small in size are well established regrowth and provide an example of the vegetation community to be achieved in locations where Camphor Laurel dominates existing vegetation on the project site.

4.1 Reference Community

One of the remnants on private property includes a large emergent Plum Pine *Podocarpus elatus,* Red Ash *Alphitonia excelsa*, Hard Quandong *Elaeocarpus obovatus*, Hoop Pine *Aracauria cunninghamii*, Francis Water Gum *Syzygium francisii*, Guioa *Guioa semiglauca*, Brown Kurrajong *Commersonia bartramia*, Foambark *Jagera pseudorhus* and Cheesetree *Glochidion sumatranum.*

The two remnants on the south bank of the creek could be classified as the Endangered Ecological Community Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion. Two threatened species listed as Vulnerable NSW (BC Act) and Commonwealth (EPBC Act) Rough-shelled bush nut *Macadamia tetraphylla* and Coolamon *Syzygium moorei* were recorded in the remnants.

Plate 2 Rainforest remnant on right bank of creek

4.2 Camphor Laurel and Coral Tree Control

Camphor Laurel is the dominant or co-dominant canopy tree with Coral Tree, along the riparian zones within the project site.

Along the east bank at the rear of the residences on Old Bangalow Road several large Camphor Laurel had fallen across the creek. Ballina Shire Council engaged a local arborist to remove the trees from the creek in addition to three large trees leaning towards the creek and likely to fall. The stumps were initially to remain in place but due to instability were removed.

Along this section of the creek Camphor Laurel dominates the west bank. The Camphor Laurel is on both sides of Crosby Lane for approximately 300metres.

Plate 3 Fallen Camphor Laurel at rear of houses

Initially areas where Camphor Laurel or Coral Tree (Indian Coral Tree *Erythrina* x *sykesii* and Cockscomb Coral Tree *E. crista galli*) dominate the canopy the restoration will consist of weed control and rely on natural regeneration. Native tree species were generally recorded in Camphor Laurel sites and seed will also be brought in by birds and bats. When the weeds are controlled the native species recruitment will occur.

Woody weeds and ground cover weeds to be controlled by cut, scrape and paint or drill and inject, followed by spot spray of small woody weeds and groundcover weeds.

When the site has stabilised then all Camphor Laurel and Coral Tree in the canopy to be drill and injected and left in situ. Follow up weed control is essential so that the native plants can establish.

Camphor Laurel adjacent to or within roadways to remain untreated if falling branches are a likely hazard. Where funds available the Camphor Laurel trees in these locations to be cut down and removed

Plate 4 Large Camphor Laurel trees along Crosbys Street to be removed

The local arborist who removed the trees from the creek recommended that the larger trees directly adjacent to Crosbys Lane should be removed using a crane. The removed trees would be placed in the adjacent paddock south of Crosbys Lane and the timber salvaged or mulched. The stumps to be treated so that they do not resprout.

5 Planting

The project site has sections of cleared land dominated on the upper bank by exotic grasses such as Para Grass, Setaria and Broad-leaved Paspalum or dense shrub weeds such as Lantana, Lady of the Night *Cestrum nocturnum* and Privets. The toe of the bank varies from pasture grasses to Typha, Para Grass and Taro. These locations will have weed control followed by planting of local native riparian and rainforest species.

Planting will focus on the strips of vegetation dominated by dense groundcover and shrubby weeds. Where native seedlings are encountered, they should be marked so as not damaged during weed control.

The majority of the planting sites are subject to flooding and the downstream sites within Zone 4 are subject to inundation on high tide.

Site preparation will include initial primary control and follow up of all groundcover and woody weeds prior to planting. When the weeds have been reduced and stabilised then planting to be undertaken. It is essential that that preparation is thorough, or the Para Grass will re-establish in the work areas.

Plantings are to be set back from roadsides a minimum of 3m. Bollards may be installed to delineate the planting area adjacent to the road.

Prior to planting if areas of erosion or bank instability are encountered then sediment control may be required to reduce impacts of sediment moving into the creek. Control will include installation of jute matting secured with timber or metal pegs or rootball placement and densely planted.

The planting will consist of riparian species on the lower bank and rainforest trees and shrubs on the upper bank. The species list consists of species occurring naturally in the reference community, within the Camphor Laurel patches and species recommended in *"The Landholders Guide to Looking After Waterways in the Richmond River Catchment*" (Rous County Council 2017).

The tubestock to be sourced from local nurseries where plants have been grown from local provenance seed. Longstem planting is recommended if available particularly in locations subject to severe flooding.

See Appendix 3 Tables 2, 3 and 4 for recommended plantings

5.1 Existing Plantings

Plantings have been undertaken in 2018 within Zone 4 by OzFish with assistance from Ballina Shire Council. The list of species planted is included in **Appendix 3**.

OzFish Planting design considerations were:

- 2m plant spacings, offset rows.
- Rows closest to creek and road edges to consist of grass species only.
- Other rows, diverse range of species tolerant to flooding.

Plate 6 OzFish planting February 2018

6 Weeds

Forty seven weeds were recorded on the site. The dominant terrestrial and aquatic weed were recorded during the site assessment, other weeds may occur that were not identified during survey for this plan. The dominant weeds are Camphor Laurel, Coral Tree, Small and Large-leaved Privet, Lady of the Night, *Ipomoea* sp, Taro and Para Grass.

See **Appendix 2** for a list of weeds recorded on the site and **Appendix 4** for Weed Control Methods.

Sixteen of the weeds identified are regionally listed weeds Asset Protection and four weeds are regionally listed Containment. **See Table 1**. **Table 2** includes the Biosecurity Priority Categories and Biosecurity Weed Management Category Objectives.

Table 1. Biosecurity Priority Weeds

Biosecurity Priority – Asset Protection	
Scientific Name	**Common Name**
Ageratina adenophora	Crofton Weed
*Anredera cordifolia**	Madeira Vine
Asparagus aethiopicus	Ground Asparagus
Cinnamomum camphora	Camphor Laurel
Coffea arabica	Coffee
Erythrina x *sykesii*	Indian Coral Tree
Delaria odorata	Cape Ivy
Desmodium intortum	Green – leaf Desmodium
Desmodium uncinatum	Silver-leaf Desmodium
*Lantana camara**	Lantana
Murraya paniculata	Murraya
Ochna serrulata	Mickey mouse Plant
Passiflora subpeltata	White Passionflower
Pinus elliottii	Slash Pine
Schefflera actinophylla	Umbrella tree
Solanum seaforthianum	Climbing Nightshade
Biosecurity Priority - Containment	
Baccharis halimifolia	Groundsel
Erythrina crista-galli	Cockscomb Coral Tree
Ipomoea alba	Moon Flower
Solanum chrysotrichum	Giant Devils Fig

- State Listed

Table 2. Biosecurity Weed Management Categories

Category	**Objective**	**Characteristics of weeds in this category**
Asset Protection	To prevent the spread of weeds to key sites/ assets of high economic, environmental and social value, or to reduce their impact on these sites if spread has already occurred.	These weed species are widespread and unlikely to be eradicated or contained within the wider regional context. Effort is focussed on reducing weed threats to protect priority high value assets.
Containment[1]	To prevent the ongoing spread of the species in all or part of the Region. *The property is located within the core infestation area (Tweed) for these weeds.*	These species have a limited distribution in the region. Regional containment strategies aim to prevent spread of the weed from an invaded part of the region (core infestation), and/or exclude the weed from an uninvaded part of the region (exclusion zone).

(North Coast Regional Weed Management Strategy 2017)

7 Management Zones

The site has been divided into six work zones to implement on-ground works (**see Figure 1**). Work zones are not numbered in order of priority for on-ground works. The priority is ranked by conservation significance, condition of the vegetation, access, available funding and Council priority. See **Table 4.** A selected section of a work zone may be prioritised if approved by Ballina Shire Council.

Refer to **Section 4 Restoration** and **Section 5 Planting** for details of on ground implementation.

The work zones and their approximate areas are listed in **Table 3**.

Table 3 Work zone areas and creek frontage

Work zone	Area (m2)	Riparian (m)
1	9000	632
2	2200	390
3	4500	105
4	12000	1120
5	16000	350
6	5000	442
Total	**48700**	**3039**

Table 4 Milestones and Activities

Milestone	Activity	Date Completed	Comments
Works Stage 1	Zone 3 and Zone 4 sections - Primary weed treatment restoration areas and site preparation planting areas. Follow up existing planting.	November 2019	Zone 3 neighbour edge priority staged weed control southern boundary.
	Zone 3 (part) and Zone 4 planting sections. Planting out of approx. 7500 plants. No planting in restoration areas.		Zone 3 planting priority on southern edge
	Zones 2 (part) 3 and 4 Temporary fencing, rootball placement, bank armouring (if required). Slashing Zone 4. Survey - Zone 6 section to ensure boundaries are defined - erect fencing, install water pump and trough.		Ballina Shire Council
	Primary weed treatment and site preparation in restoration and planting areas. Zone 1, Zone 2, Zone 5, Zone 6 (subject to approvals).		
Works Stage 2	Zones 1 and 2 - bank works and expert advice if required. Slash	November 2020	Ballina Shire Council
	Second stage bush regeneration - all locations, including follow up weeding of Zones 3 and 4 restoration and plantings.		Complete weed treatment and planting in Zone 3.
	Planting out of Zone 6.		
	Planting out of suitable areas in Zones 1, 2 and 5. Zone 5 includes The Common, areas to remain for recreational improvements.		Zone 1 and 5 include restoration of Camphor Laurel dominated vegetation.
Works Stage 3	Bollards to replace temporary fencing to protect plantings if required.	May 2021	Ballina Shire Council
	Assess if additional planting required.		Ballina Shire Council
	Final stage bush regeneration and plantings maintenance.		

Figure 2 Emigrant Creek Riparian Zones 1, 3 and 5

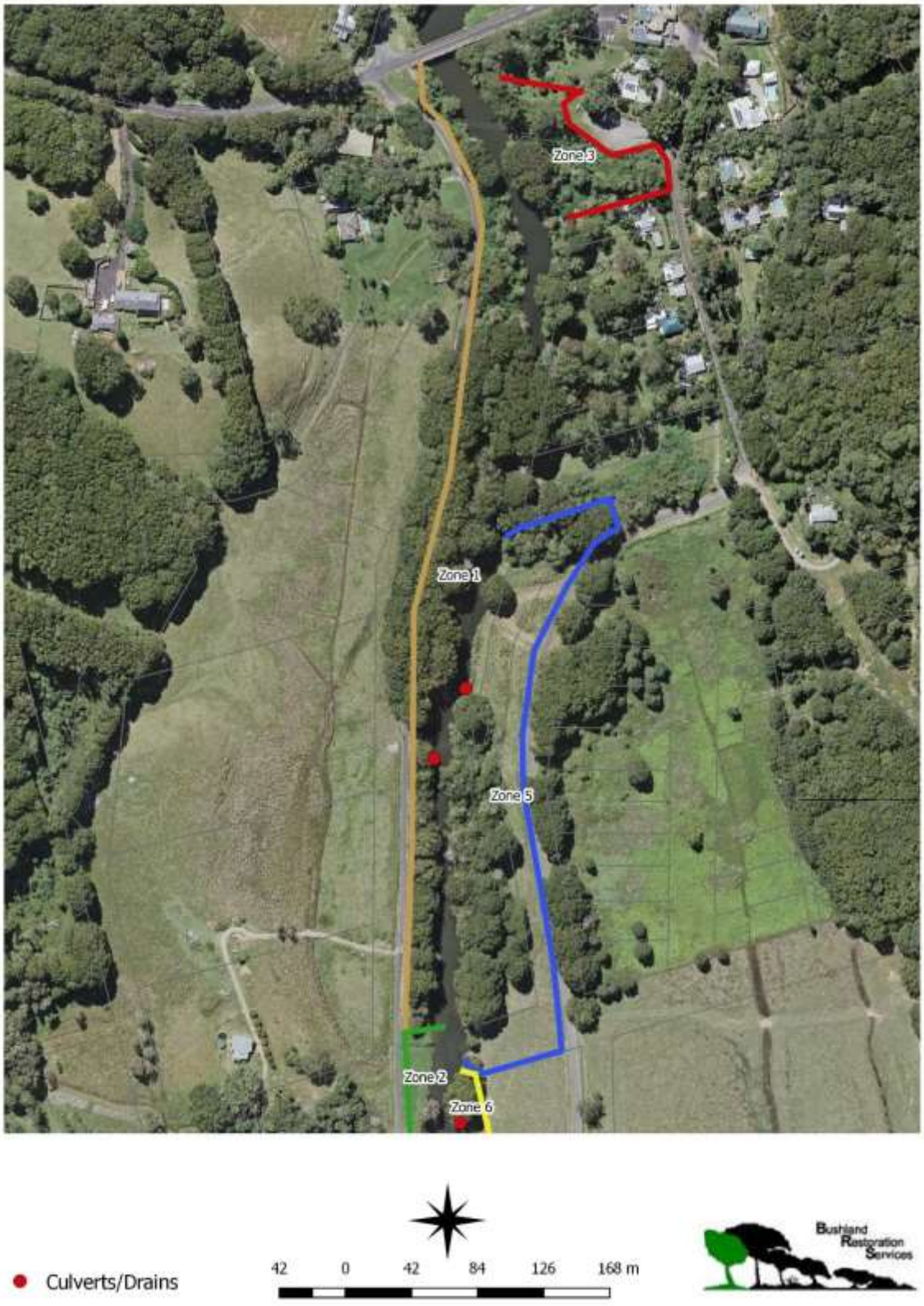
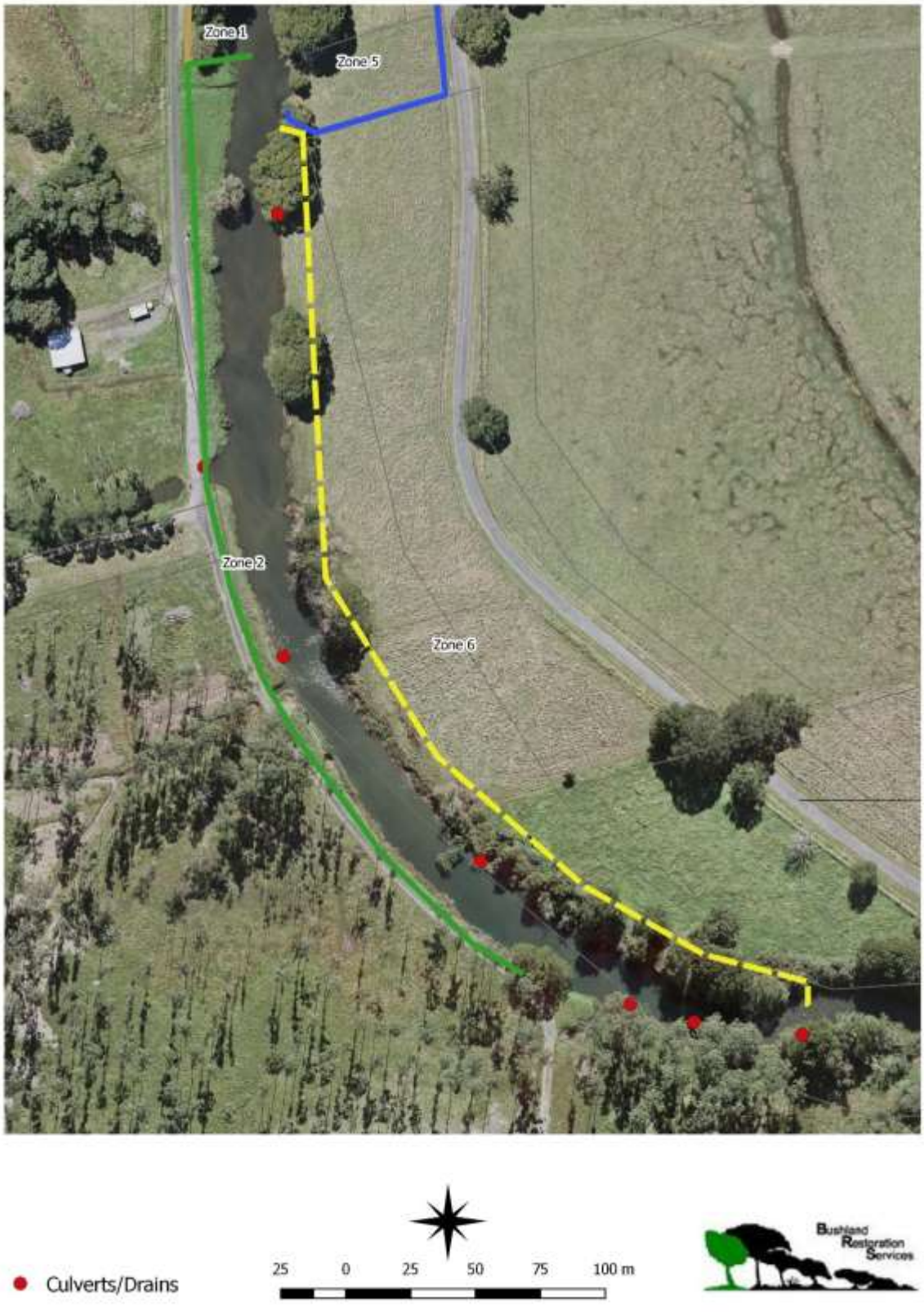


Figure 3 Emigrant Creek Riparian Zones 2 and 6



7.1 Zone 1

Zone 1 is located on the western side of Emigrant Creek and extends from the corner of Old Bangalow Road south approximately 632 metres and has an area of approximately 9000m^2. The zone varies in width from approximately 3m to 20m. The vegetation is highly degraded and dominated by a range of weeds.

At the northern corner is a dense patch of woody weeds dominated by Lady of the Night, Large-leaved Privet, Lantana, Smooth Senna, Coral Tree and Mexican Sunflower. There are also vine weeds Moonflower, Morning Glory, Coastal Morning Glory, Cape Ivy and Madeira Vine. There is a Jacaranda and two Firewheel trees near the intersection with Tintenbar Road. A powerline crosses the zone to the south of these trees.

Plate 7 Dense weed under powerline near intersection

Management Actions

Retain the Jacaranda and Flame Trees.

Woody weeds to be controlled by cut, scrape and paint or drill and inject. Ensure that Madeira Vine and Cape Ivy are thoroughly treated, and all stems treated by scrape and paint.

Follow up with spot spray. Weeds will require follow up treatments.

As weeds are dense this zone could be slashed after weeds have died back.

Plant at 1.5 m random spacings rainforest species. Select plants from Appendix 3 Table 2.

Select low growing plants to plant under the powerline. Select plants from Appendix 3 Table 3.

Follow up spot spray at regular intervals to ensure that weeds do not re-invade.

Plate 7 Avenue of large Camphor Laurel adjacent to Crosbys Lane

The southern section of the zone is dominated by Camphor Laurel in the canopy and Lady of the Night and Coral Tree in the mid. Weeds include Alexander Palm, Cocos Palm, Small-leaved Privet, Umbrella Tree, Morning Glory and Broad-leaved Paspalum.

Native rainforest trees and seedlings were recorded scattered through this section of the zone.

Management Actions
Large Camphor Laurel adjacent to road to remain untreated for future removal.
Woody weeds to be controlled by cut, scrape and paint and larger stems drill and inject.
Follow up with spot spray including weeds on lower bank.
When weeds in the mid and ground layers have died back, drill and inject Camphor Laurel and Coral Trees. Leave in situ to break down.

Follow up spot spray at regular intervals to ensure that weeds do not re-invade. Care to be taken to avoid native seedlings and groundcovers.

Monitor for natural regeneration.

7.2 Zone 2
Zone 2 is located on the western side of Emigrant Creek and extends from Zone 1 south approximately 390 metres. The boundary between zones 1 and 2 is a large drain. There is a pedestrian access through a gate to access the south of the zone. Zone 2 has an approximate area of 2200m^2 and varies in width from approximately 3m to 8m.

The vegetation is mainly exotic grasses. The northern section is dense Para Grass and Morning Glory changing to Setaria and Broad-leaved Paspalum. Other weeds include annuals such as Farmer's Friends, Blue Billy Goat Weed, Thickhead and Smart Weed and a patch of Singapore Daisy and Moonflower. There is one Coral Tree.

South of the gate is adjacent to private property and is currently grazed. This section will require fencing to exclude stock. Consult with the landholders. Fencing to be installed prior to preparation for planting.

Along the edge of the creek in the north is mainly Typha.

Management Actions
Construct electric fence along southern section to exclude stock.
Drill and inject the Coral Tree.
Spot spray patches of difficult to control weeds such as Singapore Daisy, Moon Flower and Morning Glory. Larger stems of vine weeds require cut, scrape and paint.
Drier sections of the zone to be slashed.
When grasses and other weeds reshoot follow up with spot spray.
Follow up with a second treatment or as required to reduce dense grass cover.

Plant at 1.5 m spacings rainforest species.
Select plants from Appendix 3 Table 2 for upper bank and Table 1 for lower bank.

Follow up spot spray at regular intervals to ensure that weeds do not re-invade.

Plate 8 Dense Para Grass intermingled with Morning Glory

Plate 9 Southern section recently slashed

7.3 Zone 3

Zone 3 is located between the eastern left bank of Emigrant Creek and George Street. Zone 3 has an approximate area of 4500m^2. The zone length is 105m and varies in width up to 90m. The zone is bounded on both sides by residential lots and is adjacent to the bus turning circle and entrance to a medical surgery. There is a phone line through the zone.

The vegetation is highly degraded and dominated by a range of dense weeds. Weeds include Camphor Laurel, Coral Tree, Mexican Sunflower, Lady of the Night, Madeira Vine Coffee, Large-leaved Privet, Moon Flower, Morning Glory, Coastal Morning Glory, Glycine, exotic grasses.

There are mature Flooded Gum and mature and regenerating rainforest trees in the western section adjacent to the creek and mature native trees adjacent to the entrance to the neighbour's property. The neighbour has undertaken some weed control and planting along their boundary extending into the zone. The established native trees may be planted. There is a threatened species, Coolamon *Syzygium moorei* near the creek bank.

Management Actions

Undertake the weed control and planting in two stages.
Stage 1 commence weed control in a 10m wide strip along the neighbour's boundary. When weeds are stabilised densely plant shrubby species such as Lilly Pillys to create a buffer prior to removal of the remaining weeds. Liaise with the neighbouring landholder.
Stage 2 continue weed control and planting.

Woody weeds to be controlled by cut, scrape and paint or drill and inject. Ensure that Madeira Vine is thoroughly treated, and all stems treated by scrape and paint.
Follow up with spot spray. Weeds will require a second treatment.
As weeds are dense in Stage 2 this section could be slashed after weeds have died back.

Plant at 1.5 m spacings rainforest species
Select plants from Appendix 3 Table 2.
Select low growing plants to plant under the phone line. Select plants from Appendix 3 Table 3.

Follow up spot spray at regular intervals to ensure that weeds do not re-invade.

Plate 10 Dense weed adjacent to creek and neighbouring property

Plate 11 Southern boundary where neighbour has controlled weeds

7.4 Zone 4

Zone 4 is located on the northern side of Emigrant Creek extending in a long and often very narrow strip from Tamarind Drive approximately 1120m to the west. Old Bangalow Road runs parallel to the zone. The zone has an area of 12000m^2 and varies in width from approximately 3m to 15m. There are nine culverts along this zone.

The zone includes existing plantings undertaken by OzFish in 2018. **See Plate 6** and **Figure 4**.

The vegetation varies from isolated trees, remnant vegetation dominated by Camphor Laurel, exotic grassland and creekbank dominated by Taro, Para Grass and Typha and clumps of Canna Lily.

The clear grassed sections are to be prepared and planted on the upper and lower banks. The three remnant patches are to rely on natural regeneration as there is generally a good representation of native riparian and rainforest species. Native species recorded include, Guioa, Sandpaper Fig, Riberry, Tuckeroo, Bridelia, Cheesetrees, Lilly Pilly, Cottonwood and Crinum Lily.

Plate 12 Clump of remnant vegetation including Camphor Laurel and native trees

A Traffic Plan has been prepared by Ballina Shire Council for when working adjacent to old Bangalow Road. **See Appendix 5.**

Management Actions - Remnants

Woody weeds to be controlled by cut, scrape and paint and larger stems drill and inject.
Follow up with spot spray including weeds such as Taro and Para Grass on lower bank.
When weeds in the mid and ground layers have died back, drill and inject Camphor Laurel and Coral Trees unless close to the road pavement. Leave in situ to break down.
Follow up spot spray at regular intervals to ensure that weeds do not re-invade. Care to be taken to avoid native seedlings and groundcovers.

Monitor for natural regeneration, particularly the lower banks which may require planting.

Figure 4 Emigrant Creek Riparian Zone 4

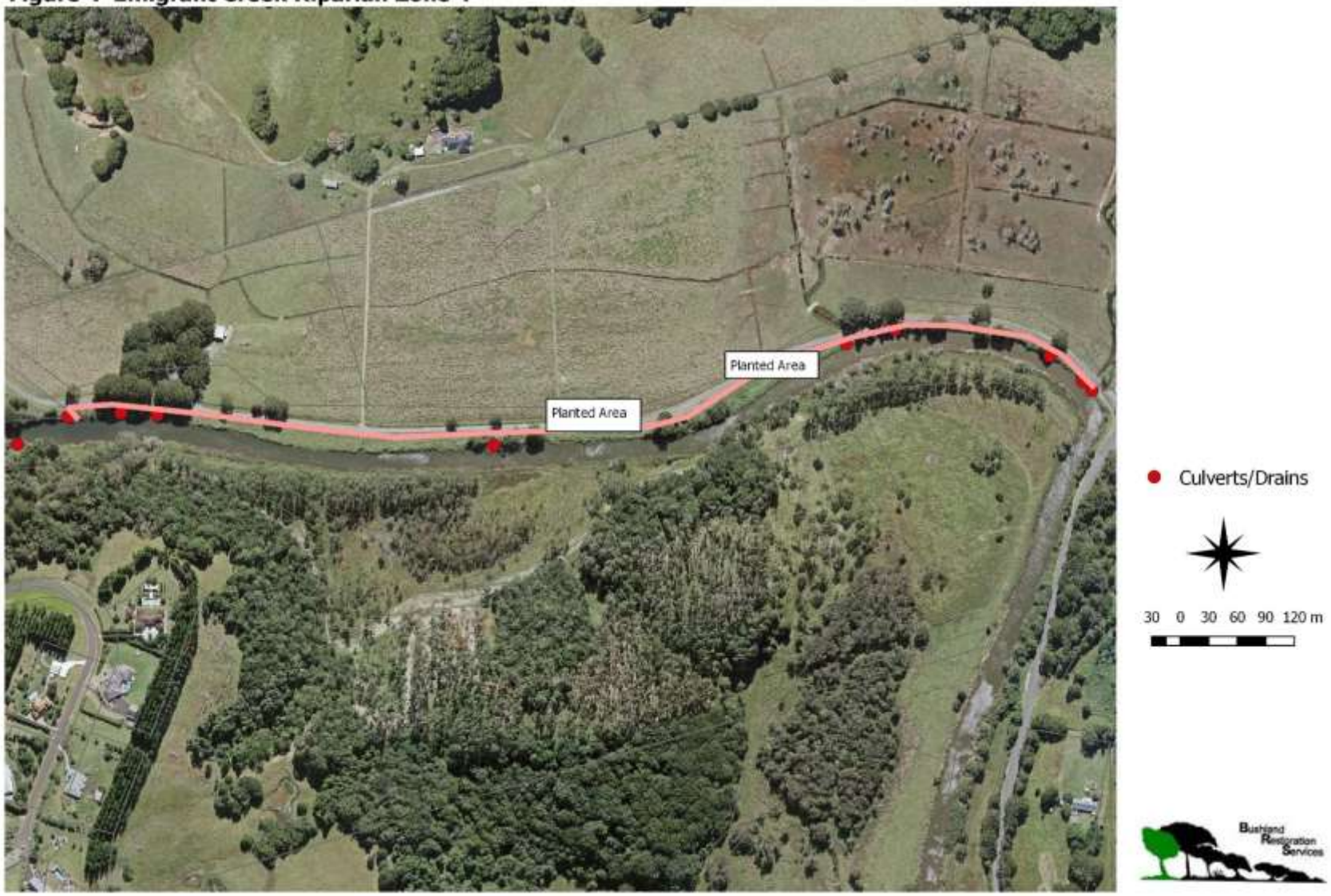


Plate 13 Dense weed, Taro and Para Grass, on the lower bank adjacent to cleared section

Management Actions – Grassed

Isolated woody weeds to be controlled by cut, scrape and paint or drill and inject.
Follow up with spot spray to control all exotic grasses. Leave a 3m strip along the roadside.
Exotic grasses will require a second treatment as Para Grass persists and may even require additional treatments. Similarly, Canna Lily and Taro will require several treatments. Beneficial to undertake thorough preparation prior to planting.
Grasses are dense in these sections and could be slashed after weeds have died back.

Plant rainforest trees at 1.5 m spacings on the upper bank.
Select plants from Appendix 3 Table 2.
Plant trees at 1.5m spacing and Lomandra, Crinum and Juncus at 0.5m spacing to create a dense cover on the lower bank.
Select plants from Appendix 3 Table 1.
Follow up spot spray at regular intervals to ensure that weeds do not re-invade.

7.5 Zone 5

Zone 5 is located between the eastern left bank of Emigrant Creek and Old Bangalow Road. Zone 5 has an approximate area of 16000m^2 and creek frontage of 350m. The zone is generally approximately 60m wide. The zone includes the cleared and grassed reserve referred to as The Common.

The Common is Public Reserve and in the future will be improved for passive recreation such as fishing and access for canoeing. Improvement could include picnic tables, signage and bollards to exclude vehicle from creekbank.

Ballina Shire Council has recommended;

1. A linear carpark with space for parallel parking up to 6 cars alongside to the roadway should be allowed. Approximately 50m x 3m in width.
2. Two pathways (or one which then branches to two locations) to two small clearings on the creek bank should be allowed. Space for a picnic table and some seats, approximately 5m x 5m, should be left on the creek bank (stability plantings on the bank and the toe are required).

Plate 14 The Common

The vegetation is mainly a strip of remnant vegetation dominated by Camphor Laurel with rainforest species. The remaining cleared section is located downstream from The Common. The creekbank is dominated by Taro, Para Grass and Typha.

The cleared sections are to be prepared and planted on the upper and lower banks, leaving the central area for future passive recreation. The remnant patches are to rely on natural regeneration as there is generally a good representation of native riparian and rainforest species.

Management Actions - Remnants
Woody weeds to be controlled by cut, scrape and paint and larger stems drill and inject.
Follow up with spot spray including weeds on lower bank.
When weeds in the mid and ground layers have died back, drill and inject Camphor Laurel and Coral Trees unless close to the road pavement. Leave in situ to break down.
Follow up spot spray at regular intervals to ensure that weeds do not re-invade. Care to be taken to avoid native seedlings and groundcovers.

Monitor for natural regeneration, particularly the gaps in vegetation and the lower banks which may require planting.

Management Actions – Grassed
Isolated woody weeds to be controlled by cut, scrape and paint or drill and inject.
Follow up with spot spray to control all exotic grasses. Leave a 3m strip along the roadside.
Exotic grasses will require a second treatment.

Plant rainforest trees at 1.5 m spacings on the upper bank.
Select plants from Appendix 3 Table 2.
Plant Lomandra, Crinum and Juncus at 0.5m spacing to create a dense cover on the lower bank.
Select plants from Appendix 3 Table 1.
Follow up spot spray at regular intervals to ensure that weeds do not re-invade.

Management Actions The Common
The Common is to be slashed by Ballina Shire Council. Areas will be left for parking, pathways and picnic tables and chairs as determined by Ballina Shire Council.

Consult Council prior to controlling the larger Camphor Laurel remaining on the bank. Council may require the trees to be removed.

Plant rainforest shade trees along upper bank and within reserve as advised by Council.

Plant Lomandra, Crinum and Juncus at 0.5m spacing to create a dense cover on the lower bank.
Select plants from Appendix 3 Table 1.

7.6 Zone 6
Zone 6 is located on the eastern bank of Emigrant Creek and extends south from Zone 5. Its extent is not clear at this time, and a survey will need to be undertaken to ensure private and public lands are appropriately delineated. Zone 6 has an estimated area of 5000m^2 and creek frontage of 442metres. Access is along a track from Old Bangalow Road on public land on boundary within Zone 5.

The zone is between Emigrant Creek and private land and is currently unfenced allowing cattle access to the creek. Fencing and off site water to be negotiated with the adjacent landholder prior to commencing restoration.

The vegetation includes remnant vegetation dominated by Camphor Laurel and Coral Tree with a good representation of rainforest species. A threatened species, Rough-shelled Bush Nut, was recorded in the remnant.

Plate 15 Remnant vegetation at south of zone

Sections of the bank are cleared to toe of bank where cattle have been accessing the creek. The vegetation is grazed pasture grasses. There is a patch of Butterfly Bush on the lower bank.

Plate 16 dense Butterfly Bush along the lower creek bank

Management Actions - Remnants
Woody weeds to be controlled by cut, scrape and paint and larger stems drill and inject.
Follow up with spot spray including weeds on lower bank.
When weeds in the mid and ground layers have died back, drill and inject Camphor Laurel and Coral Trees. Leave in situ to break down.
Follow up spot spray at regular intervals to ensure that weeds do not re-invade. Care to be taken to avoid native seedlings and groundcovers.

Monitor for natural regeneration, particularly the gaps in vegetation and the lower banks which may require planting.

Management Actions – Grassed
Isolated woody weeds to be controlled by cut, scrape and paint or drill and inject.
Follow up with spot spray to control exotic grasses.
Exotic grasses will require a second treatment.

Plant rainforest trees at 1.5 m spacings on the upper bank.
Select plants from Appendix 3 Table 2.
Plant trees at 1.5m spacing and Lomandra, Crinum and Juncus at 0.5m spacing to create a dense cover on the lower bank.
Select plants from Appendix 3 Table 1.
Follow up spot spray at regular intervals to ensure that weeds do not re-invade.

7.7 Southern side of creek

The southern bank of Emigrant Creek extends from Zone 2 to Tamarind Drive for approximately 1.5km. The zone is in the ownership of one landholder.

The vegetation varies from weedy lower banks dominated by Taro with adjacent Flooded Gum plantings to good condition rainforest remnants. See Plate 2 and cover photograph.

The landholders are committed to managing their property including weed control and riparian restoration.

The management of the riparian zone could be undertaken as recommended for Zone 4 on the opposite bank.

This area is not included in the current project but would be a valuable inclusion in future projects.

8. General Guidelines

8.1 Cultural Heritage
All staff will be inducted into aspects of Aboriginal culture that may arise on the site such as discovery or unearthing of artefacts/midden sites.

Staff will be advised that if objects are observed or uncovered on site, work must immediately cease and,

- Where material that appears to be of Aboriginal origin is identified, work will cease and the Jali Local Aboriginal Land Council and OEH will be contacted; and
- Where material that appears to be of European Heritage is discovered during the project works, works will halt until a course of action acceptable to the approving authority, Ballina Shire Council. Jali LALC will also be notified as a courtesy and to reduce the potential for misidentification of any artefacts.

8.2 Work Health &Safety
All works are to adhere to the relevant industry standards, permits, certificates and regulations.

In accordance with the *Work Health and Safety Act* 2011 and *Work Health and Safety Regulations* 2017 workers will comply to ensure safety in the workplace.

Contractors are also required to provide Workcover for employees or ensure sub - contractors hold individual personal insurance for bush regeneration work.

Contractors to Ballina Shire Council need to ensure they have submitted and adhere to an approved current Work Health and Safety System as per Council's Contractors Handbook.

A Traffic Plan has been prepared by Ballina Shire Council to be used when working in Zone 4 adjacent to old Bangalow Road. **See Appendix 5.**

8.3 Herbicide Application

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 Australian Pesticides and Veterinary Medicines Authority (APVMA). Chemical use records must also be kept and include conditions, areas treated, amount and type of chemical used and application rates in accordance with the *NSW Pesticides Act 1999*.

Bush regenerators working on site must comply with the Ballina Shire Pesticide Notification Plan. Council requires the notification three business days prior to chemical usage to Council's project manager and 48 hours notification to nearby residents by the contractor. Signage notifying the public of chemical usage and details including timing, type of chemical in use and contact details must be prominently displayed when working on public land.

9 Monitoring and Reporting

9.1 Monitoring
Effective monitoring and evaluation (M&E) of relevant vegetation attributes provides evidence that agreed project objectives and outputs are being delivered. It also assists in implementing site-

specific adaptive management approaches. Effective M&E relies on consistent comparisons between quality baseline data and data collected at regular intervals following on-ground works.

Contractor to provide:

Daily Record Sheets

A minimum two photo points per work zone and information collected using a master photo monitoring data recording sheet and photo monitoring field data recording sheet.

Methodology for photo point monitoring

Photo point to be set up within the zone marked with a numbered surveyors peg. The photo point location is to be recorded using a hand-held GPS. Ensure that photographs include a reference point such as large tree, a rock or the peg.

Additional photo points to be set up by the bush regenerators where points of interest are observed, e.g. persistent weed, natural regeneration.

Photo points are to be recorded on the Daily Record Sheet with a photopoint number, site identifier and description, date and time, direction facing and GPS co-ordinates.

Repeat photographs at same time of day. The camera lens, angle and height to be the same for each photo.

9.2 Key Performance Indicators

The monitoring program measures Key Performance Indicators (KPIs) which have been designed to gauge, progressively, the success of the program and allow for the early detection of risk factors to achieving the aims and objectives of the restoration project. This provides an opportunity for adaptive management and improves the chances for success of the project.

The key themes of interest to understanding the success of the program include:

Success of the planting being survival, growth rate and species composition;

Success of weed control techniques;
Follow up programs for weed species – different treatment regimes required by different species (e.g. some species require more frequent follow-up treatments such as those that produce a lot of seed rapidly);

Native species regeneration (rate and amount of regeneration), whether additional planting will be required); and

Changes in species abundance, diversity and cover over time (succession).

KPIs have been developed to provide a means of measuring these themes. See Table 2.

Monitoring of KPIs is to be undertaken on an initial three month basis in the first six months then biannual in the second year and on an annual basis for following years.

Table 5 Key Performance Indicators

Project objectives	KPI	Description	Target*	Annual performance achieved
Revegetate cleared areas of zone 1 with species characteristic of SSFF.	Tubestock survival	Proportion of planted tubestock survived	>/=95% Year 1 – 5	
	Growth rate	Mean height of surviving planted tubestock	Increase on previous year Trees - Mean height 1m end of year 3 Trees Mean height of 1.5m at end of year 5	
	Floristic diversity and species composition	Proportion of surviving tubestock of each species planted	90%	
Restore the existing adjacent forest and enhance revegetation areas by assisted natural regeneration.	Representation of noxious and environmental weeds	Cover of environmental weeds in ground stratum	<5% year 1 Weed cover reduced from previous year Seedlings nil flowering and fruiting year 3	
		Cover of environmental weeds in the mid and upper strata	Woody weeds and vine weeds: <1% year 1 Nil years 2 - 5	
	Recruitment of native species	Number of natural recruited stems (trees and shrubs)	Increase on previous year	
		Cover of native species in ground stratum	Increase on previous year	

*Target applies to each applicable zone individually and to the site collectively

Methodology for measuring KPIs

Due to the scale of the project, KPIs are to be assessed from representative samples. It is proposed that data be collected from three (replicate) sample areas within each work zone. The size of the sample area is expected to be in the order of 10m x 10m.

The methods for measuring the various KPIs within each sample area are described briefly below.

Tubestock survival – total surviving tubestock divided by total tubestock planted within quadrat. This KPI requires an accurate understanding of number of tubestock planted and their location, so this information should be documented at planting;

Growth rate – measure height of all tubestock within quadrat from ground surface to apex and calculate mean;

Floristic diversity and species composition – determine the proportion of each surviving tubestock to planted tubestock for each species planted;

Representation of priority and environmental weeds.

Cover of priority and environmental weeds in ground stratum – estimate foliage cover of these weeds within five randomly placed 1m x 1m quadrats nestled in the larger (10m x 10m) quadrat;

Cover of priority and environmental weeds in the mid and upper strata:

Woody weeds and vines, estimate foliage cover of these weeds within the mid and upper stratum (separately) within the larger (10m x 10m) quadrat and then averaged;

Recruitment of native species:

Number of natural recruited stems (trees and shrubs) – count number of new tree/shrub species stems within the larger (10m x 10m) quadrat;

Cover of native species in lower stratum (ground covers) – estimate foliage cover of native ground cover species within five randomly placed 1m x 1m quadrats nestled in the larger (10m x 10m) quadrat and then averaged.

9.3 Reporting

Annual Progress Report to be forwarded to the Project Manager at Ballina Shire Council and include:

- Summary of plantings and primary and follow up bush regeneration works undertaken in each zone according to the Plan of Management.
- Map of the area treated.
- Before and after photographs and completed photo monitoring data sheets.
- Results of weed control, planting and natural regeneration (KPIs).
- New records of threatened species if observed.
- Changes to management (if recommended).

10 Adaptive Management and Contingency

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 the species selection and survival rates 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 amendment to this Plan will be submitted to Ballina Shire Council for approval.

References

Ballina Shire Council (October 2018) Review of Environmental Factors-Emigrant Creek Riverbank Stabilisation and Rehabilitation.

Big Scrub Rainforest Landcare Group (2008) Common Weeds of Subtropical Rainforests of eastern Australia. Big Scrub Rainforest Landcare Group.

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NSW Department of Primary Industries, NSW WeedWise, Biosecurity Act 2015, http://weeds.dpi.nsw.gov.au/ (Sourced January 2019).

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NSW Office of Environment and Heritage
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Appendix 1 Native Species

Scientific Name	Common Name
Archontophoenix cunninghamiana	Bangalow Palm
Acrostichum speciosum	Mangrove fern
Bridelia exaltata	Scrub Ironbark
Commersonia bartramia	Brown Kurrajong
Cordyline stricta	Narrow - leaved Palm Lily
Crinum pedunculatum	Crinum Lily
Cristella dentum?	
Cupaniopsis anacardoides	Tuckeroo
Cyathea sp	Tree fern
Cyclosorus interruptus	Swamp Shield Fern
Eclipta prostrata	False Daisy
Eleocarpus obovatis	Hard Quandong
Ficus coronata	Creek Sandpaper Fig
Ficus macrophylla	Moreton Bay Fig
Ficus obliqua	Small-leaved Fig
Glochidion ferdinandi	Cheese Tree
Glochidion sumatranum	Umbrella Cheese Tree
Guioa semiglauca	Guioa
Hibiscus diversifolius	Swamp Hibiscus
Hibiscus tiliaceus	Cottonwood
Jagera pseudphorus	Foambark
Juncus kraussii	Sea Rush
Lomandra sp	Mat Rush
Ludwigia octovalvis	Willow Primrose
*Macadamia tetraphylla**	Rough-shelled Queensland Nut
Macaranga tanarius	Macaranga
Maclura cochinchinensis	Cockspur
Melanthera biflora	Sea Daisy
Persicaria strigosa	Spotted Knotweed
Phragmites australis	Common Reed
Podocarpus elatus	Plum Pine
Syzygium leuhmannii	Riberry
*Syzygium moorei**	Coolamon or Duroby
Syzygium smithii	Lilly Pilly
Toechima dasyrrhache	Blunt-leaved Steelwood
Trophis scandens	Burny vine
Typha sp	Cumbunghi

*Vulnerable NSW BC Act Commonwealth EPBC Act

Appendix 2 Weed Species

Scientific Name	Common Name
Ageratina adenophora	Crofton Weed
Ageratina riparia	Mistflower
Ageratum houstonianum	Blue Billy Goat Weed
Ambrosia artemisiifolia	Ragweed
Anredera cordifolia	Madeira Vine
Asclepias curassavica	Tropical Milkweed
Asparagus aethiopicus	Ground Asparagus
Baccharis halimifolia	Groundsel
Bidens pilosa	Farmer's Friend
Buddleja madagascariensis	Butterfly Plant
Calocasia esculentum	Taro
Canna indica	Canna Lily
Cestrum nocturnam	Lady of the Night
Cinnamomum camphora	Camphor Laurel
Coffea arabica	Coffee
Conyza sp	Fleabane
Delaria odorata	Cape Ivy
Desmodium intortum	Greenleaf Desmodium
Desmodium uncinatum	Silverleaf Desmodium
Erythrina crista-galli	Cockscomb Coral Tree
Erythrina x syksei	Indian Coral Tree
Gomphocarpus fructicosus	Milkweed
Ipomoea alba	Moon Flower
Ipomoea cairica	Coastal Morning Glory
Ipomoea indica	Morning Glory
Lantana camara	Lantana
Ligustrum lucidum	Large-leaved Privet
Ligustrum sinense	Small-leaved Privet
Ludwigia longifolia	Long leaved Primrose
Murraya paniculata	Murraya
Neonotonia wightii	Glycine
Ochna serrulata	Mickey Mouse Plant
Paspalum conjugatum	Sour Grass
Paspalum mandiocanum	Broad-leaved Paspalum
Passiflora edulis	Edible Passionfruit
Passiflora supeltata	White Passionflower
Pinus elliotii	Slash Pine
Schefflera actinophylla	Umbrella Tree
Senna pendula var *glabrata*	Winter Senna
Senna septemtrionalis	Smooth Senna
Setaria sphacelata	Setaria or Pigeon Grass

Scientific Name	Common Name
Solanum chrysotrichum	Giant Devil's Fig
Solanum mauritianum	Tobacco Bush
Solanum seaforthianum	Climbing Nightshade
Syagrus romanzoffiana	Cocos Palm
Tithonia diversifolia	Mexican Sunflower
Urochloa mutica	Para Grass

Appendix 3 Planting List

Table 1 Recommended Creek bank – Lower

Scientific Name	Common Name
Lomandra hystrix	Mat Rush
Crinum pedunculatum	Crinum Lily
Juncus kraussii	Sea Rush
Ficus coronata	Creek Sandpaper Fig
Hibiscus diversifolius	Swamp Hibiscus
Hibiscus tiliaceus	Native Hibiscus or Cottonwood
Casuarina glauca	Swamp Oak
Syzygium francisii	Giant Watergum

Table 2 Recommended Creek bank – Upper

Scientific Name	Common Name
Acmena hemilampra	Broadleaved Lilly Pilly
Alphitonia excelsa	Red Ash
Aracauria cunninghamii	Hoop Pine
Commersonia bartramia	Brown Kurrajong
Cupaniopsis anacardioides	Tuckeroo
Elaeocarpus obovatus	Hard Quandong
Elaeocarpus reticulatus	Blueberry Ash
Ficus coronata	Creek Sandpaper Fig
Ficus watkinsiana	Moreton Bay Fig
Glochidion sumartranum	Cheese Tree
Guioa semiglauca	Guioa
Jagera pseudorhus	Foambark
Lomandra longifolia	Mat Rush
Melalueca quinquenervia	Broad Leafed Paperbark
Podocarpus elatus	Plum Pine
Syzygium smithii	Common Lilly Pilly

Table 3 Recommended Plantings under powerlines

Scientific Name	Common Name
Lomandra hystrix	Mat Rush
Crinum pedunculatum	Crinum Lily
Juncus kraussii	Sea Rush
Ficus coronata	Creek Sandpaper Fig
Hibiscus diversifolius	Swamp Hibiscus
Hibiscus tiliaceus	Native Hibiscus or Cottonwood

Table 4 OzFish Planting List

Species Name	Common Name	TOTAL
Lomandra longifolia	Mat Rush	280
Lomandra hystrix	Mat Rush	240
Casuarina glauca	Swamp Oak	65
Cupaniopsis anacardioides	Tuckeroo	75
Hibiscus tiliaceus	Native Hibiscus	65
Elaeocarpus reticulatus	Bluberry Ash	65
Eucalyptus robusta	Swamp Mahogany	65
Ficus coronata	Sandpaper Fig	65
Lophostemon suaveolens	Swamp Turpentine	65
Melalueca quinquinervia	Broad Leafed Paperbark	65
Acmena hemilampra	Broadleaved Lilly Pilly	65
Acmena smithii	Common Lilly Pilly	65
Syzygium francisii	Giant Watergum	65
	TOTAL	**1245**

OzFish Planting design considerations:

- 2m plant spacings.
- Rows closest to creek and road edges to consist of grass species only.
- Other rows, diverse range of species tolerant to flooding.

Appendix 4 Weed Control Methods

Current best practice methods for weed control are described below.
Please note: (1) It is the responsibility of the herbicide user to hold an off-label permit (obtained from the National Registration Authority for Agricultural and Veterinary Chemicals) for herbicide use that is not consistent with conditions specified on the label; and (2) The methods and herbicide use rates provided below are current best practice methods. It is the responsibility of the operator to ensure methods used are current best practice and are suitable for the site and any environmental constraints experienced at the site.

Cut-scrape-paint
This weed control method applies to all woody shrubs, trees and some vines.
Cut plant low to the ground at an angle.
Apply Glyphosate immediately at the rate of 1 part Glyphosate to 1.5 parts water, with an applicator bottle or paint brush approximately 1.5 centimetres wide.
Scrape sides lightly to reveal green tissue and apply the herbicide to the scraped area.
Take care that the tip of bottle or brush is not contaminated with soil.
This method is suitable for **Senna, Privets, Buddleja and Lady of the Night** (1:1.5).
Note - all seed that has high viability and longevity, e.g. Senna spp. and other members of the Fabaceae family, or plants with a high invasive potential, such as **Umbrella Tree** *Schefflera actinophylla*, must be removed from the parent and either composted on site or removed from the site.

Gouge-paint
This weed control method applies to those plant species that have a fleshy root system, such as rhizomes or large bulbs. It is particularly appropriate for the treatment of Asparagus spp.
Gouge out sections of the fleshy base with a knife (if using on Asparagus, first cut the stems at shoulder height and also at the base).
Apply 1 part Glyphosate to 1.5 parts water immediately, with a paint brush approximately 1.5 centimetres wide.

Stem Injection
This weed control method applies to all woody trees and shrubs with a diameter of about six to ten centimetres or greater.
Drill a hole at an angle into the sap wood using an 8-10mm drill bit angle, Holes to be no >than 10cm apart.
Apply herbicide (approx. 4ml) immediately into the hole using a tree-injecting device (if using Glyphosate, apply undiluted (**Camphor Laurel**) or at the rate of 1 part Glyphosate to 1.5 parts water **Coral Tree**).
Repeat this procedure at intervals around the circumference of the tree, as close to the ground as possible. Where the presence of a crotch angle makes this difficult, drill a hole above it. Note – one row of drill holes will be sufficient for trees with trunks of six to ten centimetres; larger trunk diameters may need correspondingly more.
Treat all visible lateral roots as above.

Scrape-ditch-paint
This weed control method is applicable to many species of vines where it is desirable to treat the vines intact, particularly those with aerial tubers such as **Madeira Vine** *Anredera cordifolia* or those which will propagate from segments, e.g. **Cape Ivy** *Delairia odorata*.
Scrape the stem tissue on one side of the stem only for at least 20-30 centimetres if possible. Repeat treatment on alternate sides of stem within reach. Note - on **Madeira Vine**, it is necessary to scrape heavily. Scrape as many sections of the stem as possible.
Apply undiluted Glyphosate or Glyphosate 1:1 + Metsulfuron methyl with a paintbrush.
On stems that are thicker or horizontal, make a ditch into the stem with a knife and apply herbicide. Tubers and side roots should be treated the same way. Note - care must be taken not to sever the stem.

Spraying

This weed control method is carried out using a 15 litre backpack spray unit with a modified spray nozzle that gives a solid spray pattern. Glyphosate is the main herbicide used with the addition of a marker dye. Metsulfuron methyl can also be used for resistant species and woody weeds adjacent to grasses. It should be used with a surfactant, such as Pulse®.

Where both Glyphosate and Metsulfuron methyl are combined it is important to mix the chemicals as recommended e.g. MM must be well mixed with water prior to adding to backpack.

Dilution rates for Glyphosate and Metsulfuron methyl are in accordance with the manufacturer's recommendations and any variation requires a permit from the National Registration Authority.

Dilution rates for Glyphosate to water for treatment of some weed species are provided below:

Plants with more or less succulent leaves, e.g. **Wandering Jew** *Tradescantia fluminensis*, **Madeira Vine** (autumn to winter is the suggested time for spraying small plants), Spider/Ribbon Plants *Chlorophytum* spp. etc - 1 part Glyphosate to 50 parts water + Pulse 20ml + Dye

Lantana - 1 part Glyphosate to 100 parts water.

Seedling woody weeds such as **Lady of the Night, Senna, Privets and Buddleja**.

Para Grass use Weed Master Duo - the following information is from the label -Paragrass^ (Brachiara mutica) 200mL/15L Apply to actively growing plants when most have reached the early head stage. Per9907.

Taro use Weed Master Duo as a mist over spray 1:100 or cut and paint stems.

Other soft-leaved plants, annuals and grasses - 1 part Glyphosate to 100 parts water

Typical dilution rates for Metsulfuron methyl to water are - 1.5g Metsulfuron methyl to 10 litres water + 20 millilitres Pulse® to 10 litres water.

Overspray

This weed control method is applicable to large, dense infestations of such plants as Lantana, where it is desirable to leave the dead plants intact to prevent erosion and over-exposure of large areas, protect native seedlings from predators such as wallabies, and avoid trampling by humans.

Spray over the top of the infestation, using Glyphosate.

Any native plants that may be under the weed will be protected by the foliage cover of the weed.

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

The rate for overspraying of Lantana is 1 part Glyphosate to 100 parts water.

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

Crowning

This weed control 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).

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.

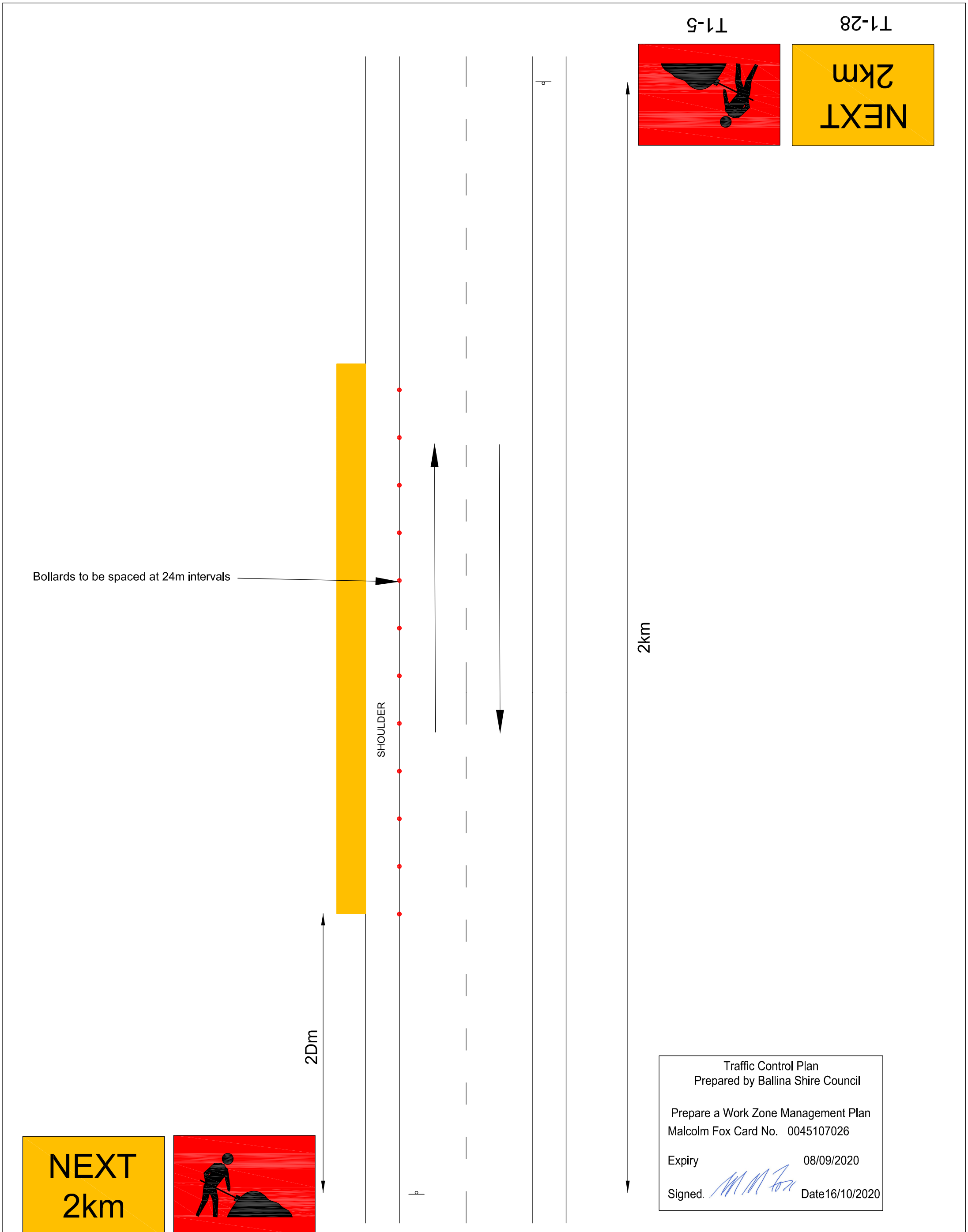
Insert the knife close to the base of the plant at a slight angle, with the tip well under the root system.

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.

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

Adapted from Joseph (2001), Big Scrub Landcare Group (2008),Chenoweth& BRS (2012).

Appendix 5 Traffic Control Plan



Traffic Control Plan
Prepared by Ballina Shire Council

Prepare a Work Zone Management Plan
Malcolm Fox Card No. 0045107026

Expiry 08/09/2020

Signed. Date16/10/2020

1. All signs are to be placed so as to be in clear an unobstructed view to on coming traffic
2. If an intersection is located between the work site and the proposed signage, additional signage is to be placed on these side streets

No.	Date	By	Change	X'd

Amendments

SURVEY	DESIGNED
DATE 09/2018	DRAWN MNF
F.B. L.B.	CHECKED
DATUM	APPROVED
DRAWING SH16 LITTER PICKUP.DWG	
Sheet 1 Of 1 Sheets	

BALLINA SHIRE COUNCIL

TRAFFIC CONTROL PLAN
LITTER PATROL / PLANTING CLEAR OF ROAD
(SHORT TERM ONE SHIFT)

Scale	Plan No.	
N.T.S.	BSC TCP NO.217	A4