53B Warriewood Road, Warriewood - Vegetation Management Plan

Legendway Pty Ltd

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Template 2.8.1

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Abbreviations

Abbreviation	Description
AABR	Australian Association of Bush Regenerators
BC Act	NSW *Biodiversity Conservation Act 2016*
CFSMF	Coastal Flats Swamp Mahogany Forest
DPI Water	Department of Primary Industries – Water
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd

Abbreviation	Description
FFA	Flora and Fauna Assessment
LGA	Local Government Area
LLS	Local Land Services
NBC	Northern Beaches Council
PCT	Plant Community Type
SMCMA	Sydney Metropolitan Catchment Management Authority
VMP	Vegetation Management Plan

1. Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Legendway Pty Ltd for the proposed 17 lot residential subdivision at 53B Warriewood Road, Warriewood located within the Northern Beaches Council (NBC) Local Government Area (LGA).

1.1 Background

The subject site encompasses 53B Warriewood Road (Lot 3 DP 1115877) in the suburb of Warriewood (**Figure 1**). The lot is to be subdivided, creating 16 residential lots, associated access roads and a public reserve lot. The plan for these works is shown in **Appendix A**.

The VMP has been prepared to meet the NSW Department of Primary Industries – Water (DPI Water) requirements under the *Water Management Act 2000*. The VMP has been prepared based on current best practice and is consistent with the DPI Water guidelines, including provision of indicative costs for management actions.

1.2 Objectives of the Vegetation Management Plan

The overall objectives of the VMP are to establish native species cover and density along the riparian corridor by revegetation works and to assist in the natural regeneration of the VMP area. The VMP area will be managed in perpetuity. This VMP covers the initial five-year period, or until the objectives and performance criteria outlined in this VMP are met. The objectives for the VMP are summarised in **Table 1**.

Table 1: VMP Objectives

Objectives	Approach
Improve ecological health and integrity along the riparian corridor	Control woody weeds, climbers and pasture grasses within the riparian bushland Maintenance weed control
Maintain and enhance habitat values	Protect existing native vegetation Control weeds and prevent new outbreaks Assist in the natural regeneration of species across the VMP area.

1.3 Preparation and implementation of this plan

This VMP has been prepared by Restoration Ecologist/s with over 5 years' experience in environmental consultancy and relevant Bachelor of Science degree.

A suitably qualified and experienced bush regeneration contractor is required to implement this VMP. They should be a member of the Australian Association of Bush Regenerators (AABR) or should possess the required qualifications and experience for membership. In addition to this, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009).

1.4 Key Terms

For the purpose of this VMP, the following terminology has been adopted:

- Subject site: The extent of 53B Warriewood, Warriewood (Lot 3 DP 1115877).
- Development area: The proportion of the site to be developed, specifically the proposed lots and roads. This area is outside the scope of the VMP area.
- VMP area: The proportion of the site to be conserved and managed by this VMP, specifically the 925 m^2 of riparian land to the south east of the development area (**Figure 1**).

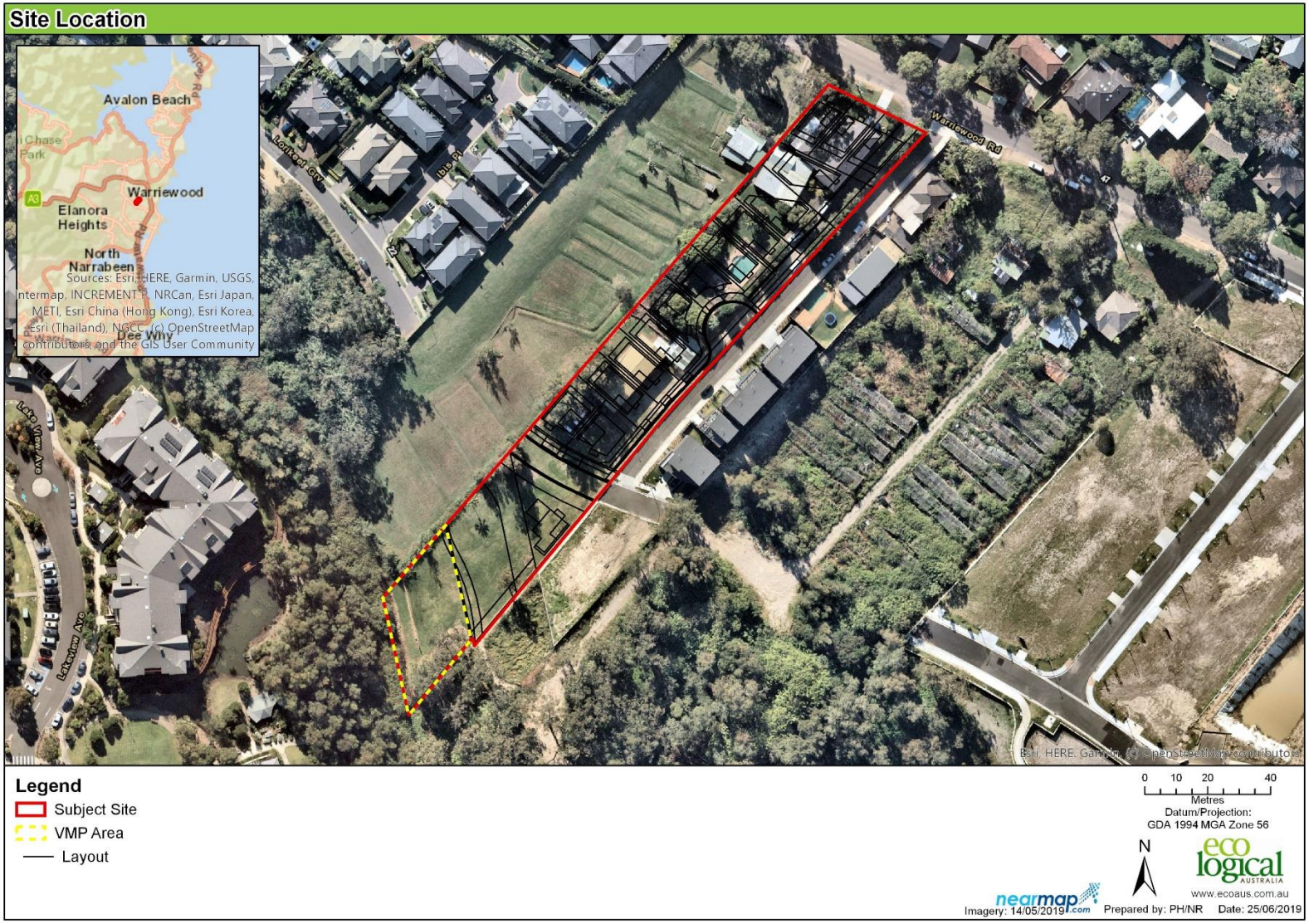

Figure 1: Site location

2. Description of the environment

2.1 Location

The subject site is located within the suburb of Warriewood, within the Northern Beaches Council LGA, is zoned R3 – Medium Density Residential and is part of the Warriewood Valley Urban Release Area. The subject site is located approximately 27 km north of Sydney CBD. The subject site is comprised of residential buildings, a swimming pool, cleared land, a riparian corridor and weeds and exotic cover.

The VMP area (925 m^2) is bound by Narrabeen Creek to the south, 53 Warriewood Road (Lot 2 DP 1115877) to the north and west and Pheasant Place to the east (**Figure 1**).

2.2 Topography and hydrology

The topography within the VMP area descends from north east to south west towards Narrabeen Creek. The site is located on the Warriewood soil landscape unit on level to gently undulating swales, depressions and infilled lagoons on Quaternary sands.

One 2nd order stream (Strahler), Narrabeen Creek, flows along the southern boundary of the site (**Figure 1**).

2.3 Vegetation community

One vegetation community has been mapped by the NSW Office of Environment and Heritage (OEH) (2016) within the subject site as Coastal Freshwater Swamp Forest. Recent validation of the vegetation within the study area during a flora and fauna assessment (FFA) identified one native vegetation community, Coastal Flats Swamp Mahogany Forest (**Figure 2**) (ELA 2019). Vegetation characteristics and community structure of the study area correspond to these findings.

Coastal Flats Swamp Mahogany Forest (CFSMF) corresponds to the Plant Community Type (PCT) 1795 – Swamp Mahogany / Cabbage Tree Palm – Cheese Tree – Swamp Oak tall open forest on poorly drained coastal alluvium in the Sydney Basin. CFSMS aligns with the *Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* vegetation community, which is listed as an Endangered Ecological Community (EEC) *Biodiversity Conservation Act 2016.*

CFSMF is found in areas of impeded drainage near coastal swamps, lagoons and along low-lying drainage flats. This open forest is dominated by *Eucalyptus robusta* (Swamp Mahogany) with a smaller tree layer of *Casuarina glauca* (Swamp Oak) and *Melaleuca linariifolia* (Flax-leaved Paperbark) and *M. styphelioides* (Prickly-leaved Tea Tree).

A distinct mesic element is present in the understorey with *Glochidion ferdinandi* (Cheese Tree) and *Livistona australis* (Cabbage Tree Palm) most prominent. Climbers such as *Stephania japonica var. discolor* (Snake Vine) and *Parsonsia straminea* (Common Silkpod) may be found winding around tree trunks and fallen branches. The ground cover is periodically wet with standing water rarely consistent throughout the year. While some sedges do occur amongst the ground cover, it is the combination of ferns, grasses and herbs that are most abundant.

In the Sydney Metropolitan Catchment Management Authority (SMCMA) area it is restricted to elevations between one and six metres above sea level (SMCMA 2016). These forests appear to be more common on low lying alluvium rather than marine sediments although there is considerable gradation between the two. Largest areas of this forest within the SMCMA occur at the Warriewood Wetlands.

CFSMF within the subject site is highly modified. It primarily persists as canopy trees including *Eucalyptus robusta* and *Casuarina glauca*. The understorey had been under-scrubbed, with groundcovers restricted to mown lawn and grasses primarily comprised of the exotic grass *Cenchrus clandestinus* (Kikuyu).

A list of flora species recorded within the site have been detailed in **Appendix B**.

2.4 Weeds

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds (**Table 2**). Under the Act all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Specific legal requirements apply to State determined priorities under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022, while Regional priorities include outcomes to demonstrate compliance with the general biosecurity duty and strategical responses in the region to achieve relevant management objectives (Great Sydney Local Land Services 2017). Weeds listed as 'other weeds of regional concern' under the plan warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

Of the weeds identified during the field survey, four have been listed as State level priority weeds, two listed as Regional level priority weeds, and seven listed as other weeds of regional concern. The weeds present, their priority listing under the Act, the associated asset / value at risk and whether they are Weeds of National Significance (WoNS), are presented in **Table 2**. A full list of weeds recorded during the field survey is provided in **Appendix B**.

Table 2: A list of priority weeds and Weeds of National Significance identified within the VMP

Scientific Name	Common Name	WoNS	Biosecurity Act 2015
State level priority weeds (Whole of State)			
Anredera cordifolia	Madeira Vine	Yes	Asset Protection
Asparagus aethiopicus	Asparagus Fern	Yes	Asset Protection
Rubus fruticosus agg.	Blackberry	Yes	Asset Protection
Senecio madagascariensis	Fireweed	Yes	Asset Protection
Regional level priority weed (Greater Sydney Region)			
Cestrum parqui	Green Cestrum	No	Asset Protection

Scientific Name	Common Name	WoNS	Biosecurity Act 2015
Ludwigia peruviana	Water Primrose	No	Asset Protection
Other weeds of regional concern			
Ageratina adenophora	Crofton Weed	No	
Araujia sericifera	Moth Vine	No	
Erythrina x *sykesii*	Coral Tree	No	
Senna pendula	Senna	No	
Solanum mauritianum	Wild Tobacco	No	
Tradescantia fluminensis	Trad	No	
Zantedeschia aethiopica	Arum Lily	No	

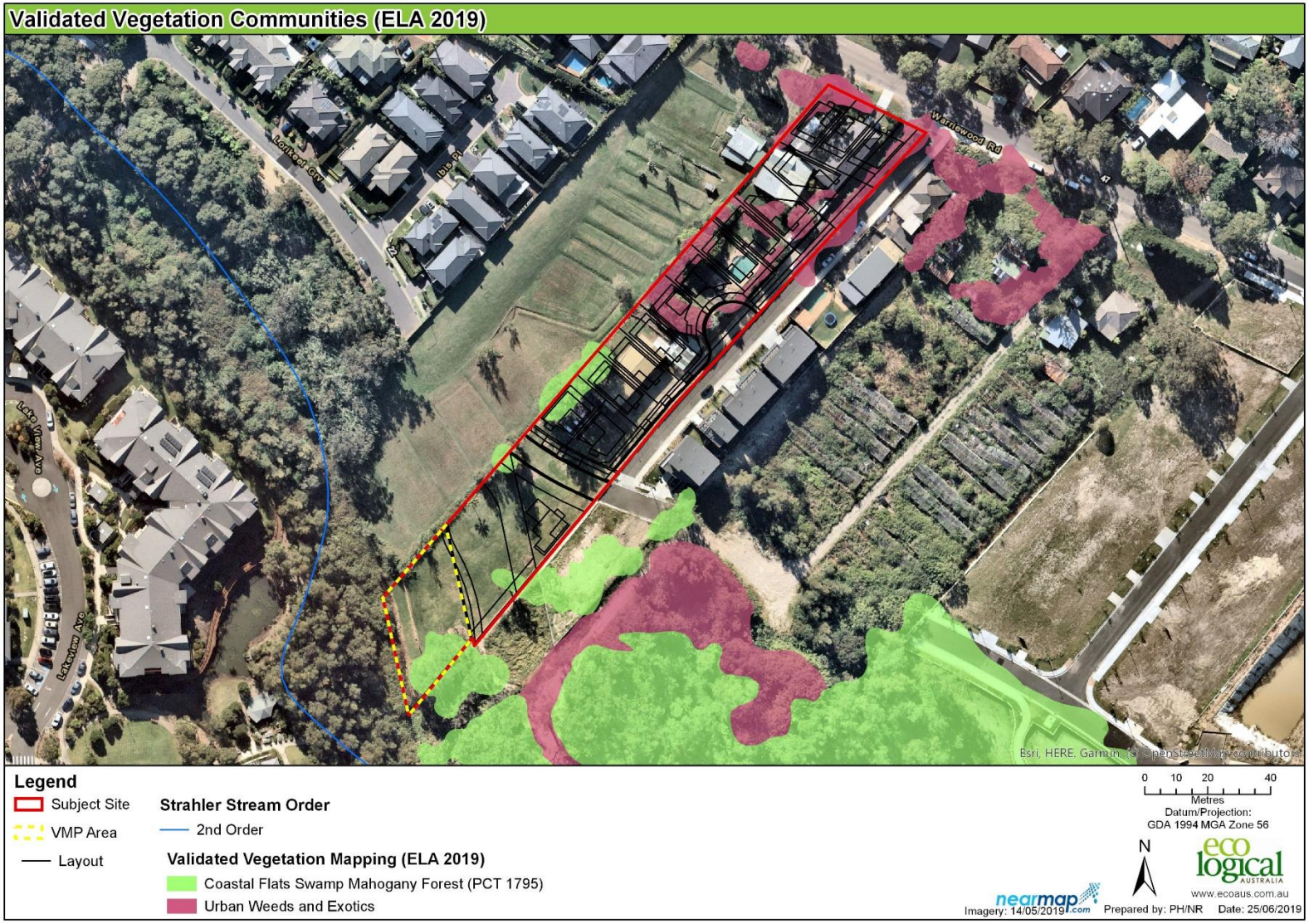

Figure 2: Vegetation communities within the subject site (ELA 2019)

3. Construction and preliminary works

The civil construction company shall be responsible for the following works.

3.1 Fencing and signage

The edge of the VMP area where it borders the development footprint is to be fenced with temporary construction fencing to prevent civil construction machinery from entering the VMP area unless under supervision from a suitably qualified ecologist or bush regenerator. Sediment fencing will also be required to prevent sediment movement into the VMP area

Informational signage must be installed on the construction fencing that identifies that there is to be no entry into the VMP area without an ecologist or bush regenerator present.

3.2 Soil and water management

An Erosion and Sediment Control Plan, preferably as part of a Construction Environmental Management Plan, must be developed and implemented prior to any on-ground works. These should be in accordance with best management practices as described in Landcom's Blue Book (2004).

Prior to construction commencing sediment fencing will be required around the construction area to prevent sediment running into the VMP area and limit the spread of weed propagules in soil sediments during the construction period.

3.3 Preclearance and earthworks supervision

During construction activities, when clearing areas of existing vegetation, earthworks and tree removal should be undertaken with the fauna ecologist or wildlife carer to supervise works. All timber should be retained onsite, with mulch stockpiled for use within VMP area, all viable seed and genetic material to be collected and all timber cut into logs to be utilised as habitat for native fauna.

3.4 Pest control

Pest control is the responsibility of the land holders, which is to be undertaken by relevant contractors in consultation with Local Land Services (LLS) and NBC.

During the site inspection, evidence of rabbits was observed in the VMP area. Rabbits have potential to impede the success of the VMP. It is recommended that construction fencing, and sediment fencing, be installed in such a way that can also exclude rabbits (see **Appendix C**). A rabbit control program may be required for the site. If required, it should be implemented based on identification and fumigation of rabbit warrens, particularly once the exclusion fencing has been installed. This is to be undertaken in consultation with LLS.

The site is to be constantly monitored for evidence of rabbit activity, which will be included in annual monitoring reports. Any damage by rabbits, primarily due to grazing regenerating native vegetation, will require rectification.

3.5 Fauna habitat enhancement

The protection of native biodiversity is important in the long-term health and rehabilitation of native ecological communities. Although the VMP contains a high proportion of exotic vegetation, native fauna, namely birds, reptiles and amphibians, have adapted to these environments. The removal of a large coverage of weeds from within the VMP area in a relatively short timeframe may result in the displacement of native fauna species. This is a concern for maintaining local biodiversity, considering the amount of urban development in adjacent areas.

Bringing the bush back manual by Department of Infrastructure, Planning and Natural Resources (2003) provides practical management techniques to minimise the impacts to native fauna during bush regeneration works. Recommendations relevant to this VMP include:

- staged or mosaic pattern of weed removal on degraded sites, involving areas no larger than 20m x 20m
- concentrating the removal of dense woody weed infestations outside peak bird breeding times
- spray herbicides in cooler seasons to reduce impacts on amphibians
- retain woody weed piles as fauna habitat and for erosion control
- work in areas where native resilience is higher before targeting degraded patches.

4. Vegetation management works

4.1 VMP management zones

The total VMP area is 925 m^2 and encompasses the public reserve area to the south of the proposed residential development (**Figure 3**). There are two management zone for this VMP:

- Zone 1: Revegetation
- Zone 2: Creek Channel

4.1.1 Zone 1: Revegetation

Zone 1 encompasses approximately 836 m^2 of mown grassland between the proposed residential development and Narrabeen Creek. A small portion of the proposed shared pathway is included in the north-eastern corner of the zone.

Vegetation throughout Zone 1 is in poor condition and is primarily comprised of exotic grasses and herbaceous weeds including *Cenchrus clandestinus* (Kikuyu) and *Stenotaphrum secundatum* (Buffalo Grass) with isolated woody weeds including *Cestrum parqui* (Green Cestrum) and *Erythrina* x *sykesii* (Coral Tree). A small stand of native canopy comprised of *Eucalyptus robusta* (Swamp Mahogany) is present within the southern end of the VMP area adjacent to Narrabeen Creek.

Weed management works throughout this zone will require the treatment of all weeds prior to revegetation works. Smaller isolated patches of woody weeds can be treated using hand pulling and cut and paint methods. Large, individual weed trees can be treated using drill and fill methods and left in situ to provide habitat. Vine weeds can be treated using hand pulling, scraping and painting and spraying herbicide application. Exotic groundcovers will be sprayed using a non-selective herbicide (e.g. Roundup Biactive®). This will likely require a minimum of at least two spray treatments, with follow-up required if further germination of weeds occurs.

For more information on specific weed control techniques, see **Appendix C**.

Mulch will be installed to a depth of 100 mm prior to revegetation works throughout the zone, as identified in **Table 3**, and as per the specifications provided in **Appendix C**.

Following primary weed control, approximately 100% of this zone is expected to require revegetation to reinstate the native CFSMF community throughout all vegetation strata as identified in **Table 3** with revegetation densities as identified in **Table 4**. All plantings need to be from CFSMF species as per the recommended planting list included in **Appendix D**.

4.1.2 Zone 2: Creek Channel

Zone 2 encompasses approximately 89 m^2 of Narrabeen Creek including riparian bushland and open water.

Vegetation throughout Zone 2 is in poor condition and is primarily comprised of woody and herbaceous weeds including *Erythrina* x *sykesii* and *Ludwigia peruviana* (Water Primrose). Weed management works throughout this zone will require the ongoing suppression of all weeds to prevent encroachment into Zone 1.

4.2 Weed control

4.2.1 Primary and secondary weed control

All weeds, including woody weeds in the understorey will require treatment. Secondary and maintenance weed control will be required following primary weed control and revegetation. During these weed control activities care must be taken to avoid natural regeneration of native species.

Primary and secondary weed control will include woody weed and vine weed control, specifically the control of *Araujia sericifera*, *Cestrum parqui* and *Erythrina* x *sykesii*. Juvenile *A. sericifera* plants can be hand-pulled, provided the whole root is removed. *C. parqui* and *E.* x *sykesii* plants can be treated using drill and fill and scrape and paint methods. Chemical and mechanical control techniques will be required in follow up treatments. Follow up treatments of woody weeds including *Ligustrum* spp. seedling growth will be required.

For more information on specific weed control techniques, see **Appendix C**.

4.2.2 Maintenance

Following primary and secondary weed removal, all areas will require ongoing maintenance to control weed regrowth from the soil seed bank. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) as per specifications provided in **Appendix C**.

Maintenance will be undertaken on a regular basis in the peak growing seasons (spring and summer), with less frequent visits in cooler periods (autumn and winter). Maintenance programs will also comment on other site issues such as rabbit activity. Maintenance work will include actions to encourage native regeneration where it is not occurring naturally. These actions include techniques such as soil disturbance, niche seeding and transplanting.

Table 3: Planting assumptions and mulch requirements

Zone	Description	Total area (m²)	Reveg. Area (%)	Reveg. area (m²)	Mulch (%)	Mulch area (m²)
1	Revegetation	836	95%	784	100%	784
2	Creek Channel	89	0%	-	-	-
	Total	***925***	**-**	***784***	**-**	***784***

Table 4: Revegetation densities

Zone	Description	Vegetation community	Reveg. area (m²)	Planting densities (per m²)				Total numbers
				Trees	Shrubs	Herbs /Scramblers	Sedges / Grasses	
1	Revegetation	Coastal Flat Swamp Mahogany Forest (PCT 1795)	784	1/25	1/10	1	3	***3,246***
	Total		***784***	***31***	***78***	***784***	***2,352***	***3,246***

Figure 3: Vegetation management zones

5. Implementation schedule

5.1 Implementation schedule

The VMP area will be managed in perpetuity with an initial implementation period of five (5) years.

An indicative implementation schedule for the initial 5 years has been provided in **Table 5**. Responsibilities have been identified as below:

Key	Civil construction activities
	Vegetation management works

5.2 Adaptive management

As this is a long-term project that will be implemented over several years, an adaptive management approach will be implemented that enables the successful contractor to learn from and respond to successful and unsuccessful techniques used on the site. In its simplest form this may include the substitution of species identified in the planting table or for undertaking advanced direct seeding techniques in place of manual planting techniques for revegetation.

The success of the works will be determined by meeting the performance criteria identified in **Table 6**. Contractors have the flexibility to implement different techniques to those specified here providing that performance criteria are met. Any major departures from the VMP or proposed changes to performance criteria must be approved in writing by NBC.

Table 5: Implementation schedule

Treatment	Year 1				Year 2				Year 3				Year 4				Year 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Civil works																				
Install construction fencing																				
Install sediment fencing																				
Install informational signage																				
Revegetation																				
Seed collection, cleaning, storage																				
Site Preparation																				
Install mulch																				
Tubestock, supply and install																				
Replacement tubestock, supply and install																				
Irrigation																				
Weed control																				
Primary																				
Secondary																				
Maintenance																				
Other works																				
Monitoring and reporting																				
Pest control (if required)																				

6. Monitoring and reporting

The bush regeneration contractor and the land manager will monitor the vegetation for changes over time. Information gained through the monitoring and reporting process will identify works that have and have not been successful, and the reasons for their success or failure.

The aim of monitoring is to measure the effectiveness of the control actions being undertaken to achieve the desired outcome. It will identify non-conformance and provide the land manager with the ability to implement corrective actions. Information derived from the results of monitoring will also be used in adaptive management (i.e. learning from past experience to inform future priorities and work plans). For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish.

Finally, monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

6.1 Monitoring

Monitoring will be undertaken by photo monitoring. Monitoring will need to be implemented prior to works commencing to establish a benchmark for performance, and to occur on an annual basis until the completion of the project. Monitoring results will be included in the progress report.

Photo monitoring points should be set-up using a permanent reference point to provide a visual reference of changes in the vegetation. Photo monitoring to include:

- set up a minimum of three photo monitoring points within the VMP area
- place two six-foot star pickets 10 m apart
- record the location (eastings and northings) of the first star picket with a GPS
- as well as the bearing to the second star picket
- take a digital photo from the first star picket looking towards the second star picket, showing the entire length of first star picket
- label each digital image with a unique reference number that indicates where the photo was taken (i.e. the photo monitoring point) and the date it was taken (e.g. 01_200330 for a photo taken at the first photo monitoring point on the 30th March 2020).

6.2 Progress reports

Progress reports are to be provided for on an annual basis until the completion of the project. This reporting includes the implementation of the monitoring actions specified in **Section 6.1** and a description of the works that have been undertaken. These reports will be submitted to NBC. Reports will include at a minimum:

- the time period the report relates to
- qualifications and experience of contractors
- certification of seed and local provenance stock
- a summary of works carried out within the period including:

  - date and time of site visits
  - works completed on the site at each visit
  - a table detailing total man hours for each task carried out on site
  - methods of weeding undertaken and details of herbicide use
  - numbers of tubestock planted if applicable
  - methods implemented for Assisted Natural Regeneration
  - photo and quadrat monitoring results to date
- a description of any problems encountered in implementing the works outlined in this VMP and how they were overcome
- any observations made, including new plant species recorded (native and weed species), comments on rates of regeneration and any problems which impact on the implementation of the VMP
- if applicable, the results of the implementation works in relation to the relevant performance criteria.

6.3 Performance criteria

The performance criteria are detailed in **Table 6**.

Failure to meet these performance criteria will mean that the maintenance period will be extended until they are achieved. Therefore, maintenance must continue until NBC agrees that the objectives and performance criteria have been met and the maintenance period has concluded. The author of this VMP or equally qualified and experienced person must prepare a statement certifying the compliance of the performance criteria at the end of the 5-year period.

If monitoring indicates that the VMP tasks are not resulting in achievement of the performance criteria, the task program will be revised. Legendway Pty Ltd and the bush regeneration contractor, in consultation with NBC, can adapt these criteria as required in response to the success of rehabilitation works.

Table 6: Performance criteria

Management Zones	Year 1	Year 2	Year 3 – 4	Year 5
All Zones	• Commencement of all tasks outlined in the VMP or evidence of planning for their implementation *Civil construction works:* • All construction and sediment fencing installed • Information signage installed • All earthworks completed under the supervision of an ecologist or bush regenerator • Pest control management plan in consultation with LLS, with rabbit fencing installed as required • Soil preparation works completed to specifications in **Section 3.2** • All rubbish and debris removed *Vegetation management works:* • A minimum of 85% survival rate of all vegetation strata planted in each zone (e.g. tree, shrub and groundcover) • No area greater than 2m x 2m without surviving revegetation • Maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. tree for tree, etc.) and must not decrease species diversity. Any new species must be from the community being emulated and of local provenance • Treatment of any new weed infestations • Monitoring and reporting undertaken in accordance with **Section 6**.			
	• Treat 100% of priority weeds • Treat 50% of other weeds • Treatment of new weed breakouts	• No greater than 10% cover by priority weeds • No greater than 40% cover by other weeds • Suppression of all weeds during revegetation • 85% survival rate of plantings, replacement plantings where required	• No greater than 10% cover by priority weeds • No greater than 20% cover by other weeds • 85% survival rate of plantings, replacement plantings where required	• No greater than 5% cover by priority weeds • No greater than 15% cover by other weeds • 85% survival rate of plantings, or equivalent regeneration

7. Cost

The cost of implementation for five-year period is approximately **$50,000** exclusive of GST and CPI. An indicative annual costing timeline is provided in **Table 7**.

Rates and costs are based on typical commercial rates. Assumptions that have been made regarding the estimation of costs have been outlined below.

7.1 Construction and preparation works

Civil construction activities are identified in **Table 6** and have not been included in **Table 7**.

7.2 Vegetation management works

7.2.1 Weed control techniques

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost **$1,100** for a team of two bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

7.2.2 Revegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tubestock costs have been budgeted at an estimated $4.50 per tree and shrub including tree guards, planting, water crystals, fertiliser and initial watering, and an estimated $2.50 per grass, sedge and groundcover including planting, water crystals and initial watering.

A total of approximately **3,500** plants will be required to achieve the densities identified in the VMP. The total estimated cost of revegetation is approximately **$10,000** for tubestock installation, including a 15% rate for replacement plantings to be installed over a period of three years following initial revegetation works.

It has been assumed that mulch will be generated from site works, with costs provided for mulch spreading / installation only, this has been estimated at a cost of $2.50 / m². Note that if this is not the case, then this mulch will need to be brought in, increasing the expected cost.

7.2.3 Seed collection

Budget for the collection of seed has been included as a separate task. If further seed collection works are required, this may be an additional cost.

7.2.4 Monitoring and reporting

Bush regeneration contractors or ecologists will undertake the monitoring and reporting identified in this VMP. This includes:

- initial setup of the photo points and conducting the baseline surveys
- preparing a yearly report, including photo points and vegetation surveying until the completion of the project

7.3 Pest control works

Costs for pest control works over the length of the maintenance period are difficult to predict and as such have not been included in the costings. The need and level of pest control works will be assessed in the monitoring reports and an approach will be determined in consultation with NBC.

Table 7: indicative VMP costings

Treatment	Establishment	Maintenance				Total
	Year 1	Year 2	Year 3	Year 4	Year 5	
Revegetation						
Seed collection, cleaning, storage	$487	$0	$0	$0	$0	$487
Site Preparation	$392	$0	$0	$0	$0	$392
Jute Matting / Mulch	$5,096	$0	$0	$0	$0	$5,096
Tubestock, supply and install	$8,225	$0	$0	$0	$0	$8,225
Replacement tubestock, supply and install	$0	$822	$0	$0	$0	$822
Irrigation	$784	$118	$0	$0	$0	$902
Weed control						
Primary	$2,418	$0	$0	$0	$0	$2,418
Secondary	$1,504	$1,504	$0	$0	$0	$3,009
Maintenance	$0	$4,282	$4,282	$4,282	$4,282	$17,128
Associated costs						
Disbursements	$392	$579	$428	$428	$428	$2,255
Monitoring & Reporting	$1,853	$1,853	$1,853	$1,853	$1,853	$9,267
Totals	**$21,152**	**$9,158**	**$6,563**	**$6,563**	**$6,563**	**$50,001**

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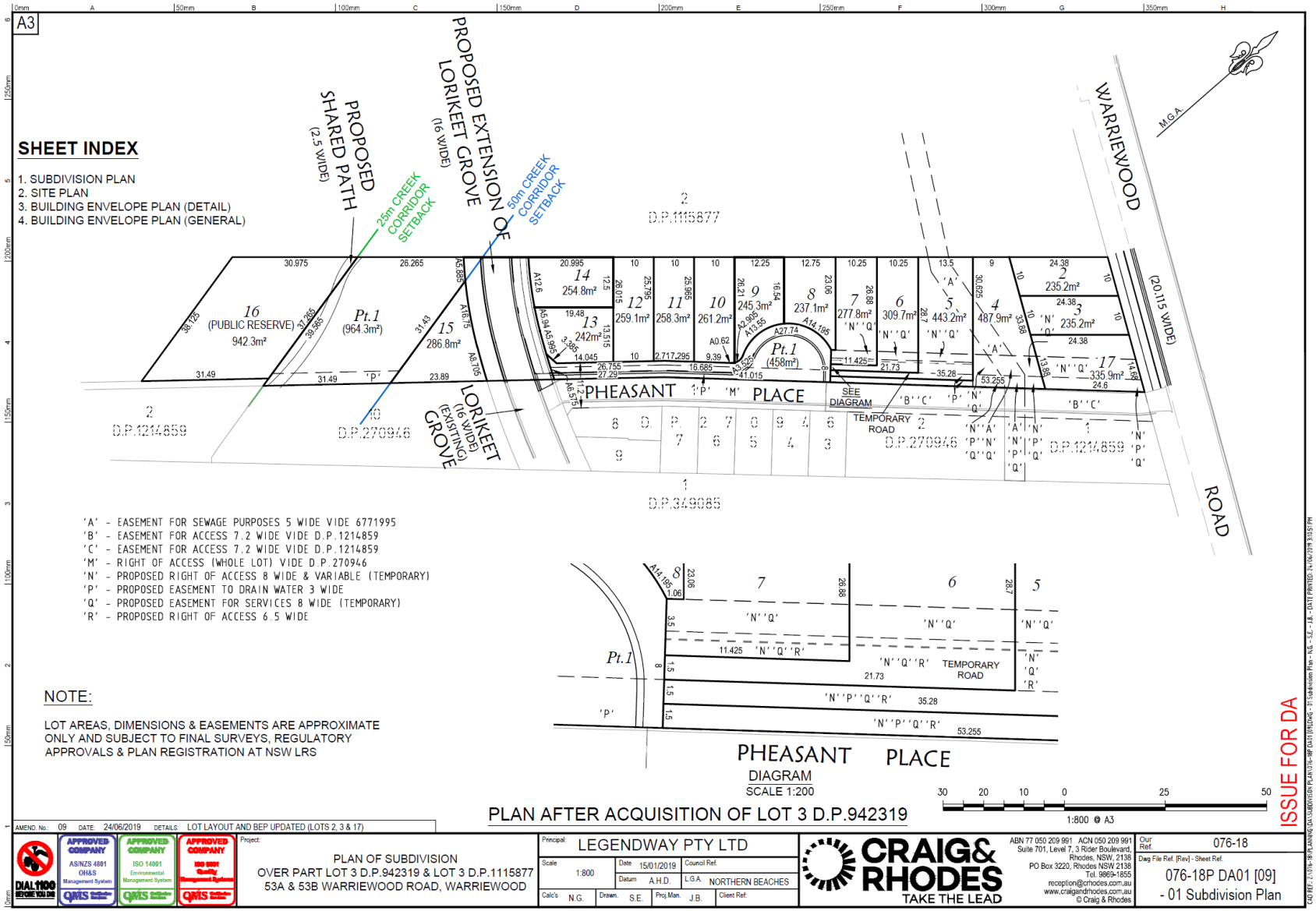
Appendix A : Development plan (Craig & Rhodes)


SHEET INDEX
1. SUBDIVISION PLAN
2. SITE PLAN
3. BUILDING ENVELOPE PLAN (DETAIL)
4. BUILDING ENVELOPE PLAN (GENERAL)
PROPOSED SHARED PATH (2.5 WIDE)
PROPOSED EXTENSION OF LORIKEET GROVE (16 WIDE)
25m CREEK CORRIDOR SETBACK
50m CREEK CORRIDOR SETBACK
WARRIEWOOD ROAD
(20.115 WIDE)
M.G.A.
PHEASANT PLACE
LORIKEET GROVE (16 WIDE) (EXISTING)
TEMPORARY ROAD
SEE DIAGRAM
D.P.1115877
D.P.1214859
D.P.270946
D.P.349085
'A' - EASEMENT FOR SEWAGE PURPOSES 5 WIDE VIDE 6771995
'B' - EASEMENT FOR ACCESS 7.2 WIDE VIDE D.P.1214859
'C' - EASEMENT FOR ACCESS 7.2 WIDE VIDE D.P.1214859
'M' - RIGHT OF ACCESS (WHOLE LOT) VIDE D.P.270946
'N' - PROPOSED RIGHT OF ACCESS 8 WIDE & VARIABLE (TEMPORARY)
'P' - PROPOSED EASEMENT TO DRAIN WATER 3 WIDE
'Q' - PROPOSED EASEMENT FOR SERVICES 8 WIDE (TEMPORARY)
'R' - PROPOSED RIGHT OF ACCESS 6.5 WIDE
NOTE:
LOT AREAS, DIMENSIONS & EASEMENTS ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEYS, REGULATORY APPROVALS & PLAN REGISTRATION AT NSW LRS
PHEASANT PLACE DIAGRAM
SCALE 1:200
PLAN AFTER ACQUISITION OF LOT 3 D.P.942319
1:800 @ A3
ISSUE FOR DA
AMEND. No.: 09 DATE: 24/06/2019 DETAILS: LOT LAYOUT AND BEP UPDATED (LOTS 2, 3 & 17)
PLAN OF SUBDIVISION
OVER PART LOT 3 D.P.942319 & LOT 3 D.P.1115877
53A & 53B WARRIEWOOD ROAD, WARRIEWOOD
LEGENDWAY PTY LTD
CRAIG& RHODES
TAKE THE LEAD
076-18
076-18P DA01 [09]
- 01 Subdivision Plan

Appendix B : Existing vegetation species list

Scientific name	Common name
Native Species	
Brachychiton acerifolius	Illawarra Flame Tree
Callistemon viminalis	Weeping Bottlebrush
Casuarina glauca	Swamp Oak
Cayratia clematidea	Native Grape
Commelina cyanea	Commelina
Cynodon dactylon	Couch
Dianella caerulea	Blue Flax-lily
Eucalyptus robusta	Swamp Mahogany
Glochidion ferdinandi	Cheese Tree
Melaleuca linariifolia	Flax-leafed Paperbark
Parsonsia straminea	Common Silkpod
Persicaria decipiens	Slender Knotweed
Syzygium paniculatum (horticultural variety)	Magenta Lilly Pilly
Urtica incisa	Stinging Nettle
Exotic Species	
Agapanthus spp.	Agapanthus
Ageratina adenophora	Crofton Weed
Anredera cordifolia	Madeira Vine
Araujia sericifera	Moth Vine
Asparagus aethiopicus	Ground Asparagus
Bidens pilosa	Cobbler's Pegs
Cenchrus clandestinus	Kikuyu Grass
Centaurium erythraea	Common Centaury
Cerastium sp.	Chickweed
Cestrum parqui	Green Cestrum
Cirsium vulgare	Spear Thistle
Clivia sp.	Clivia
Conyza bonariensis	Fleabane
Cyperus eragrostis	Umbrella sedge
Ehrharta erecta	Panic Veldt

Scientific name	Common name
Erythrina x sykesii	Coral Tree
Hydrocotyle bonariensis	Largeleaf Pennywort
Ligustrum lucidum	Broad-leaved Privet
Ludwigia peruviana	Water Primrose
Modiola caroliniana	Red-flowered Mallow
Nothoscordum gracile	Onion Weed
Paspalum dilatatum	Paspalum
Photinia sp.	Photinia
Plantago lanceolata	Lamb's Tongue
Ricinus communis	Castor Oil
Rubus fruticosus agg	Blackberry
Rumex crispus	Dock
Senna pendula	Senna
Sida rhombifolia	Paddy's Lucerne
Solanum nigrum	Blackberry Nightshade
Solanum mauritianum	Wild Tobacco
Sonchus oleraceus	Common Sowthistle
Stenotaphrum secundatum	Buffalo Grass
Strelitzia nicolai	Bird of Paradise
Trachelospermum jasminoides	Star Jasmine
Tradescantia fluminensis	Trad
Trifolium sp.	Clover
Vicia spp.	Vetch
Zantedeschia aethiopica	Arum Lily

Appendix C : Techniques and specifications

WEED CONTROL

Weed control involves a combination of mechanical, physical and chemical techniques to remove the weeds and prevent regrowth. Weed control will be undertaken across the entire zone. A selection of the best suited weed control method within the site depends on a number of factors including:

- the species or combination of weeds being targeted
- the density of the weeds
- resources available (time, labour, equipment and finances)
- weather conditions of the day

WEED CONTROL TECHNIQUES

Detail of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley Method and other techniques described in Buchanan (2000). Management techniques for different types of weeds are provided below.

Annual grasses

Annual grasses should be hand removed or spot sprayed where isolated or in low concentrations. Larger patches of annual grasses may be slashed/brush cut in late spring to early summer, after flowering, but prior to seed set. For most species, slashing/brush cutting prior to late spring through to early summer will promote vigorous growth and should not occur. However, some annual grasses can grow and produce seed at any time of the year dependent on climatic conditions such as high rainfall and warm temperatures. Monitoring of annual species should be undertaken and if new growth occurs, the same treatment will be applied to the new growth to prevent seed production. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Perennial grasses

Perennial grasses, such as *Cenchrus clandestinus* (Kikuyu) and *Ehrharta erecta* (Panic Veldt Grass) will be hand removed where isolated or in low concentrations. Larger patches may be slashed prior to seed production in spring or summer (depending on the growth cycle of the species) and the regrowth spot-sprayed 2-3 weeks later when it is actively growing and approximately 10 cm in length. Monitoring of these species will occur and if new seed production occurs, the same treatment will be applied again as required. However, slashing will not reduce the presence of exotic grasses on its own and must always be combined with targeted removal to reduce densities and allow for native regeneration. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Woody weeds

Follow up treatment of woody weeds, including *Cestrum parqui* (Green Cestrum) and *Erythrina* x *sykesii* (Coral Tree) will be controlled by the scrape and paint or drill and fill method using a non-selective herbicide. The most appropriate method to be used depends on the size of the individual to be removed

and will be determined by the bush regeneration contractor. Primary weed control should use techniques that will not encourage flushes of secondary weed growth. All seedlings of woody weeds will be hand pulled or spot-sprayed with a non-selective herbicide.

Creepers and climbers

The control of creepers, including *Araujia sericifera* (Moth Vine), varies depending on the species. For the most part, seedlings will be hand pulled, while mature plants can be controlled by the stem-scrape method or spot spraying using a non-selective herbicide. The precise method to be used will be determined by the bush regeneration contractor depending on the species, size and reproductive status of the individual. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

Herbaceous weeds

Where individual plants of herbaceous weeds, including *Senecio madagascariensis* (Fireweed), *Solanum* sp. and *Bidens pilosa* (Cobbler's Peg) are found, they will be hand pulled prior to flowering. Where large swaths of these species occur, they will be sprayed using a non-selective herbicide. If high densities of mature stands occur, weeds may be slashed first using a brush cutter and any subsequent regrowth sprayed. Regular monitoring of these species will be required to prevent seed production. *Cirsium vulgare* (Spear Thistle) will not be hand-pulled due to its thorns and instead will be treated using cut and paint methods or spot sprayed for larger infestations using a non-selective herbicide. All vegetative material that is pulled out and has the potential to regrow if deposited on ground will be bagged and removed from site.

Management of weed waste

All weed propagules, especially priority weeds, will be bagged and disposed of as directed by legislation at facility licensed to receive green waste. All weed waste without propagules will be composted onsite in small unobtrusive piles.

Herbicide use

The use of herbicide to control weeds should be carefully considered. Herbicide must only be used for the purpose described on the product label, as per the NSW *Pesticides Act 1999.* Herbicide use should assess potential long-term impacts of the technique, including whether the proposed works address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method for the control and eventual eradications of some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. A glyphosate-based herbicide, formulated for use near waterways, will be used if works require herbicide application near waterways, a (e.g. Roundup Biactive®).

Broad-leaf selective herbicide may be used as per the NSW Weed Control Handbook (DPI 2018). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways.

Registration and records must be kept in accordance with the NSW *Pesticides Regulation 2017*.

REVEGETATION WORKS

Revegetation has the dual aim of both re-establishing the original native vegetation community at the site and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak flows due the increased run-off from the hard surfaces created by the associated residential development. Any plantings should consist of local provenance stock.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the root ball. Fertiliser should be added to each hole dug as per the label specifications. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. Initial irrigation of the plantings is essential to ensure that the soil forms around the root ball and air pockets are removed. This will be required unless sufficient rainfall (approx. 10mm) occurs on the day of planting.

Tree guards will need to be installed on each tree or shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance works. Bio-degradable tree guards are recommended to protect the seedlings. Following the revegetation works, irrigation needs to be undertaken for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting site.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been completed. A maximum rate of attrition of 15% is to be tolerated, with any plant loss above this rate to be replaced at the contractor's expense.

Mulch can be derived from vegetation removed from the development area, if available. Alternately, mulch should be comprised of un-composted wood (preferably wood waste), with a particle size of 15 mm to 40 mm, with no fines, and good air-filled porosity. Mulch should not contain any weed seeds, nor be derived from diseased trees or from any part of the tree lower than 1 m above the ground. Mulch, where required, should be installed to a depth of 100 mm.

Jute matting, where required, must be comprised of 100% biodegradable jute fibres with a minimum weight of 680g/m2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m2 and each roll overlapped by 100 mm.

Seed collection

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected as within close proximity (i.e. <20km) to the site. However, soil type, climate and aspect of the collection site(s) should also be

considered. Native grasses typically have much larger dispersal mechanisms and are to be collected from within the Illawarra Escarpment.

Where species identified in this VMP cannot be sourced, they may be substituted for other Coastal Flats Swamp Mahogany Forest species as identified by Keith and Scott (2005). Species must be substituted with species of a similar form, e.g. trees for tree, grasses for grasses, etc. Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

Record keeping of seed collection and planting locations are to follow the Florabank guidelines (Mortlock, 2000). A Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works. The bush regeneration contractor is responsible for recording this information and providing it to NBC.

BUSH REGENERATION CONTRACTORS

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators (AABR) or fulfil the membership criteria. Additionally, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

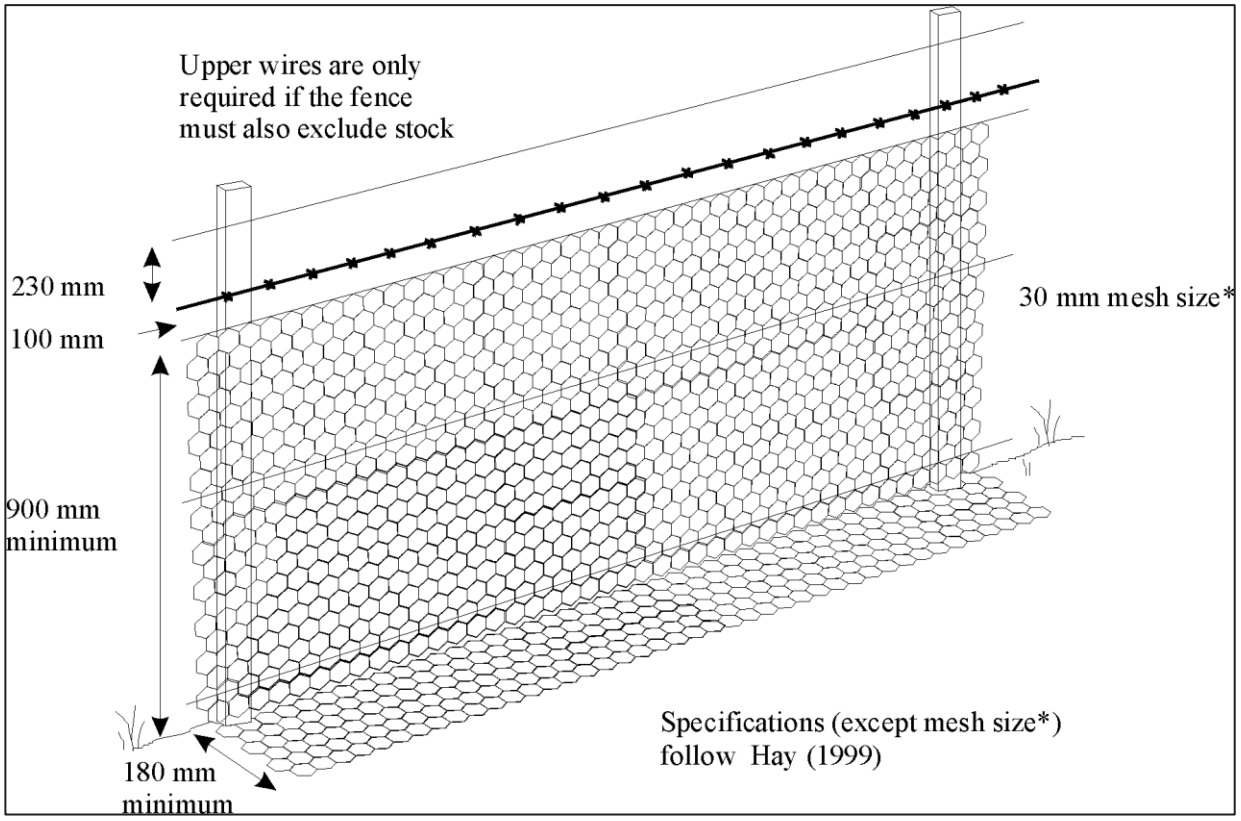
HYGIENE PROTOCOLS

To avoid introducing soil pathogens / diseases in particular *Phytophthora cinnamomi* (Root rot disease) onto site a hygiene protocol should be undertaken as per the guidelines developed by the Royal Botanic Gardens in '*Best Practice Management Guidelines for Phytophthora cinnamomi with the Sydney Metropolitan Catchment Management Authority'*.

For Bush Regenerators all tools and boots should be washed down and thoroughly cleaned of soil / mud using a solution of water and disinfectants prior to undertaking works onsite. All machinery should be thoroughly cleaned of all soil / mud / debris prior to working within the VMP area.

RABBIT EXCLUSION FENCING

Rabbit proof fencing may be required to be installed to the guidelines in the Commonwealth Department of the Environment Catalogue of fence designs. The fencing will need to be a minimum of 90mm high, with a 180 mm skirt as per the figure below.



Recommended fencing for rabbit exclusion (DoEE 2004)

Appendix D : Recommended planting list

Form	Scientific Name	Common Name
Trees (>6 m)	*Allocasuarina littoralis*	Black She-oak
	Casuarina glauca	Swamp Oak
	Eucalyptus botryoides	Bangalay
	Eucalyptus longifolia	Woollybutt
	Eucalyptus resinifera subsp. *hemilampra*	Red Mahogany
	Eucalyptus robusta	Swamp Mahogany
	Ficus coronata	Sandpaper Fig
	Livistona australis	Cabbage Tree Palm
	Lophostemon suaveolens	Swamp Turpentine
	Melaleuca ericifolia	Swamp Paperbark
	Melaleuca linariifolia	Flax-leaved Paperbark
	Melaleuca quinquenervia	Broad-leaved Paperbark
	Melaleuca styphelioides	Prickly-leaved Tea Tree
Shrubs (1.5 m - 6 m)	*Acacia irrorata*	Green Wattle
	Acacia longifolia	Coastal Wattle
	Acmena smithii	Lilly Pilly
	Banksia oblongifolia	Fern leaved Banksia (N-Ulla)
	Banksia spinulosa	Hairpin Banksia
	Breynia oblongifolia	Coffee Bush
	Callistemon salignus	Willow Bottlebrush
	Dodonaea triquetra	Large leaf Hop-bush
	Elaeocarpus reticulatus	Blueberry Ash
	Glochidion ferdinandi	Cheese Tree
	Gynochthodes jasminoides	Sweet Morinda
	Homalanthus populifolius	Bleeding Heart
	Leptospermum polygalifolium subsp. *polygalifolium*	Tantoon
	Melaleuca sieberi	Sieber's Paperbark
	Polyscias sambucifolia	Elderberry Ash
Groundcovers	*Adiantum aethiopicum*	Maiden Hair Fern
	Blechnum camfieldii	Eared Swamp Fern
	Calochlaena dubia	Rainbow Fern
	Centella asiatica	Indian Pennywort
	Dianella caerulea	Blue Flax Lily
	Glycine clandestina	Twining Glycine

Form	Scientific Name	Common Name
	Gonocarpus tetragynus	
	Hydrocotyle sibthorpioides	
	Hypolepis muelleri	Harsh Ground Fern
	Isachne globosa	Swamp Millet
	Parsonsia straminea	Common Silkpod
	Pratia purpurascens	Whiteroot
	Pteridium esculentum	Common Bracken
	Stephania japonica var. discolor	Snake Vine
	Telmatoblechnum indicum	Swamp Water Fern
	Villarsia exaltata	Yellow Marsh Flower
	Viola banksii	Wild Violet
	Viola hederacea	Ivy-leaved Violet
Sedges, rushes & grasses	*Baumea articulata*	Jointed Twig Rush
	Baumea juncea	Bare Twig Rush
	Carex appressa	Tall Sedge
	Entolasia marginata	Bordered Panic
	Entolasia stricta	Wiry Panic
	Gahnia clarkei	Tall Saw-sedge
	Gahnia sieberiana	Red-fruit Saw-sedge
	Imperata cylindrica var. major	Blady Grass
	Lomandra longifolia	Ribbon Grass
	Oplismenus aemulus	Basket Grass
	Oplismenus imbecillis	Basket Grass
	Phragmites australis	Common Reed
	Themeda triandra	Kangaroo Grass

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