128 Andrews Road, Penrith

Vegetation Management Plan

Prepared for
Cadence Property Group Pty Ltd

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Abbreviations

Abbreviation	Description
AABR	Australian Association of Bush Regenerators
BC Act	*Biodiversity Conservation Act 2016*
CEEC	Critically Endangered Ecological Community
DA	Development Application
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
FW	Freshwater Wetland
LGA	Local Government Area
LLS	Local Land Services
HRCC	Hawkesbury River County Council
PCC	Penrith City Council
RFEF	River-flat Eucalypt Forest
VMP	Vegetation Management Plan
WM Act	*Water Management Act 2000* (NSW)
WoNS	Weeds of National Significance

1 Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Cadence Property Group Pty Ltd for the proposed development at 128 Andrews Road, Penrith located within Penrith City Council (PCC) local government area (LGA).

1.1 Background

The site encompasses 128 Andrews Road (Lot 20/DP1216618) and a small section of 130-172 Andrews Road (Lot 13/DP217705) in the suburb of Penrith (**Figure 1**). Part of the site is to be developed, creating a new warehouse, two detention basins and an access road from Andrews Road. The plan for these works is shown in **Appendix A**.

This VMP has been prepared as per the recommendations of the Flora and Fauna Assessment (FFA) prepared by ELA for the site in October 2018.

In addition, this 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 throughout the waterfront lands by revegetation works and to assist in the natural regeneration of the VMP area. 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 throughout remnant bushland and wetland	• Control woody weeds, climbers and pasture grasses within the remnant bushland and wetland • 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.
Enhance native fauna habitat	• Increase native flora species diversity to provide native fauna habitat • Install woody debris for native fauna habitat

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).

A project restoration ecologist is to be assigned to the project. The project restoration ecologist is to have a minimum of five years' experience in managing restoration sites, have a relevant university degree and have completed TAFE Certificate III in Land Management and membership of the Association of Australian Bush Regenerators (or having the prerequisite qualifications and experience for membership).

1.4 Key Terms

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

- Subject Site: The extent of 128 Andrews Road, Penrith (Lot 20/DP1216618) and a small section of 130-172 Andrews Road (Lot 13/DP217705)
- 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 14.97 ha of vegetation to the east of the development area and 1.16 ha of detention basins adjacent to the development area (**Figure 1**).

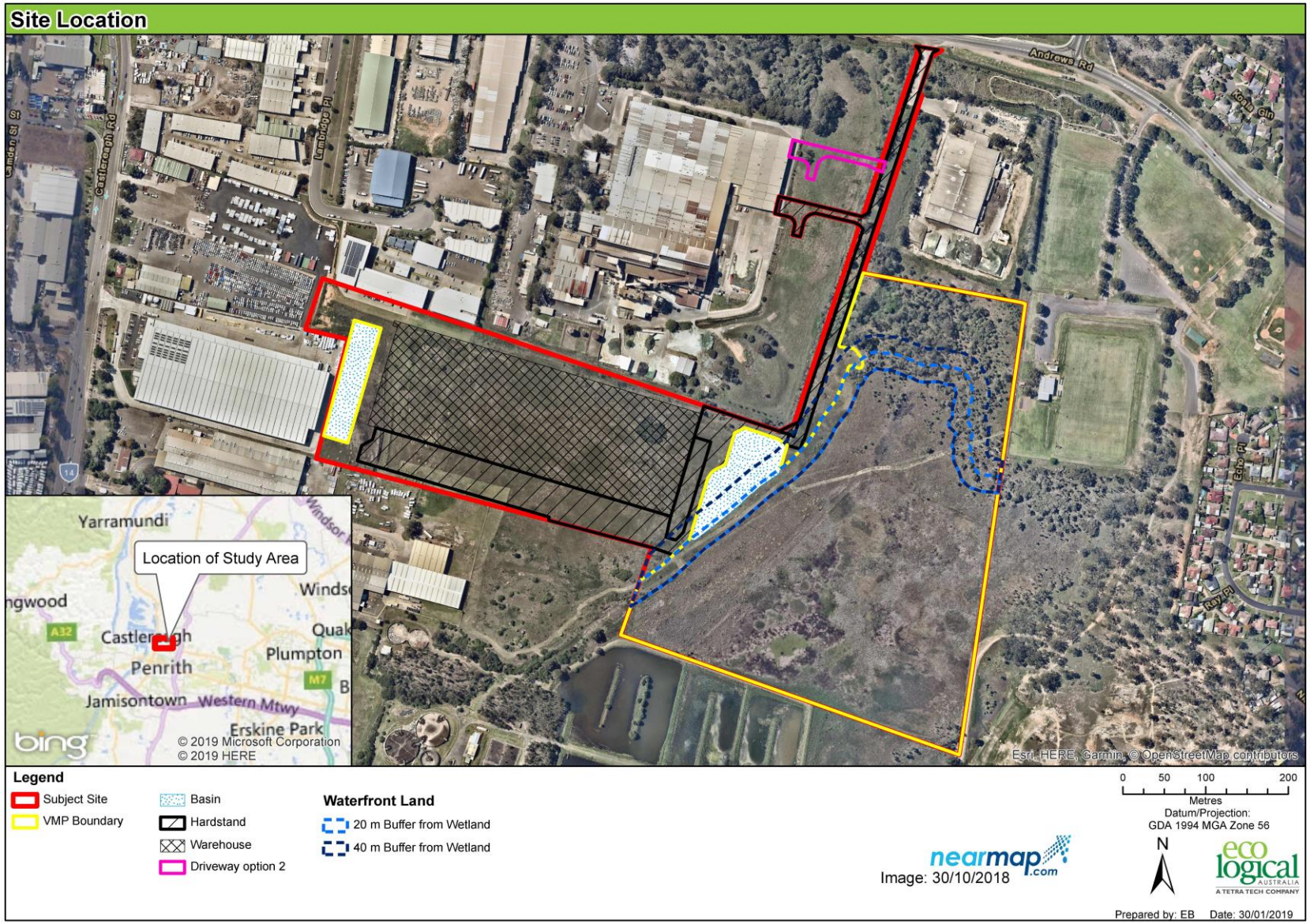

Figure 1: Site location

2 Description of the environment

2.1 Location

The subject site is located within the western Sydney suburb of Penrith, within PCC LGA. The VMP area (15.24 ha) is bound by Penrith Wastewater Treatment Plant to the south, Nepean Rugby Park to the east and warehouses and industrial zoned lands to the north and west (**Figure 1**).

An access track intersects through the VMP area, which has been assumed to be utilised for access to infrastructure and will be retained in its current condition.

2.2 Topography and hydrology

Two soil landscapes have been mapped within the subject site; these are Luddenham and Richmond (Bannerman and Hazelton 1990).

The majority of the subject site is located on Richmond soil landscape which is characterised by quaternary terraces of the Nepean and Georges Rivers, Relatively flat and level. Splays, levees provide local relief of <3mm. Soils are poorly structured orange to red clay loams, clays and sands. Texture may increase with depth. Ironstone nodules may be present (Bannerman and Hazelton 1990).

The eastern portion of the subject site is located on Luddenham soil landscape. Luddenham soil landscape is characterised by undulating to rolling low hills on Wianamatta Group shales, often associated with Minchinbury Sandstone. The soil landscape is underlain by Wianamatta Group Ashfield Shale and Bringelly Shale formations. Soils are shallow dark podzolic soils or massive earthy clays on crests; moderately deep red podzolic soils on upper slopes; moderately deep yellow podzolic soils and prairie soils on lower slopes and drainage lines (Bannerman and Hazelton 1990).

The subject site is situated on relatively level ground draining from west to east into a large freshwater wetland. The wetland is recognised as Kingswood Park Wetland (No.158) under the *Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean (No 2- 1997)*.

2.3 Vegetation community

One vegetation community, Shale Plains Woodland (SPW), was mapped by NSW Office of Environment and Heritage (OEH) in the subject site (2013). Recent validation of the vegetation within the site during the FFA survey by ELA (2018) identified five vegetation communities based on Tozers (2003) classification. They are Cumberland Plain Woodland (CPW), River-flat Eucalypt Forest (RFEF), Freshwater Wetland (FW), Artificial Wetland (AW), Exotic Vegetation (EV) and Native Grassland (NG). Vegetation characteristics and community structure of the subject site correspond to these findings.

2.3.1 Cumberland Plain Woodland

CPW is listed as Endangered Ecological Community (EEC) under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Critically Endangered Ecological Community (CEEC) under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). However, CPW in the subject site did not meet the area requirements or native perennial cover thresholds for listed requirements under the EPBC Act.

Cumberland Plain Woodland (CPW) is characterised by an upper-storey that is usually dominated by *Eucalyptus moluccana* (Grey Box) and *E. tereticornis (Forest Red Gum)*, often with *E. crebra* (Grey

Ironbark), *E. eugenioides* (Narrow-leaved Stringybark), *Corymbia maculata* (Spotted Gum) or other less frequently occurring eucalypts, including *Angophora floribunda*, *A. subvelutina* (Broad-leaved Apple), *E. amplifolia* (Cabbage Gum) and *E. fibrosa* (Broad-leaved Ironbark). The community may have an open stratum of small trees that may include any of these eucalypts, as well as species such as *Acacia decurrens* (Black Wattle), *A. parramattensis* (Parramatta Wattle), *A. implexa* (Hickory Wattle) or *Exocarpos cupressiformis* (Native Cherry) (NSW Scientific Committee 2011).

The CPW identified in the subject site was recorded in one small patch which was characterised by scattered *Eucalyptus crebra* (Narrow-leaved Ironbark). The understorey was disturbed and dominated by exotic species such as *Bidens pilosa* (Cobblers Pegs), *Foeniculum vulgare* (Fennel), *Eragrostis curvula* (African Love Grass) and *Paspalum dilatatum* (Paspalum).

2.3.2 River-flat Eucalypt Forest

River-flat Eucalypt Forest (RFEF) within the subject site conforms to the Endangered Ecological Community (EEC) *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions* (River- Flat Eucalypt Forest) listed under the *Biodiversity Conservation Act* 2016 (BC Act).

The canopy consisted of *Eucalyptus tereticornis* (Forest Red Gum) and a row of *Casuarina glauca* (Swamp Oak) located along the fenceline with regeneration observed. The mid-storey was characterised by *Melaleuca linariifolia* (Flax-leaved Paperbark) and *Acacia parramattensis* (Parramatta Wattle). Exotic species influenced this community mainly around the edge of the patch and included species such as *Foeniculum vulgare* (Fennel), *Cestrum parqui* (Green Cestrum), *Sida rhombifolia* (Paddys Lucerne) *Rubus fruticosus* (Blackberry), *Bidens pilosa* (Cobblers Pegs) and *Asparagus asparagoides* (Bridal Creeper).

The understorey was dominated by *Carex appressa* (Tall sedge) and *Cynodon dactylon* (Couch) where the vegetation is influenced by the adjacent wetland and overland water that this community receives from adjacent land. Other native species included *Microlaena stipoides* (Weeping grass), *Juncus usitatus* and *Bolboschoenus fluviatilis* (Marsh Club-rush).

2.3.3 Freshwater Wetland

Freshwater Wetland (FW) confirms to the endangered ecological community *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Freshwater Wetlands), which is listed under the BC Act.

Freshwater Wetlands on Coastal Floodplains are associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally, occurs below 20 m elevation on level areas.

At the time of the FFA survey no standing water was present in either of the two wetlands and the landscape was extremely dry. The only vegetation present within the artificial wetland was *Phragmites australis* (Common Reed) located in the northern half of the wetland. The wetland to the east of the subject site was dominated by *Carex appressa* (Tall sedge), *Juncus usitatus*, *Bolboschoenus fluviatilis* (Marsh Club-rush) and *Typha orientalis* (Broadleaf Cumbungi).

2.3.4 Artificial Wetland

Artificial Wetland (AW) was been identified as largely human induced with vegetation that did not conform to a vegetation community. Its occurrence is likely to be as a result of historical farming practices and

changes to the surrounding built areas. During the FFA site inspection the only native vegetation present within the 'wetland' was a patch of *Phragmites australis* (Common Reed) which is a colonising reed in the northern portion. Disturbance in this area is evident from the presence of exotic species such as *Cortaderia selloana* (Pampas Grass) and recent removal of vegetation and soil. The wetland also currently receives untreated water from a stormwater pipe overflow and runoff from adjacent land

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. 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, six have been listed as State level priority weeds and fourteen 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)			
Asparagus asparagoides	Bridal Creeper	Yes	Asset Protection
Cestrum parqui	Green Cestrum	No	Asset Protection
Lantana camara	Lantana	Yes	Asset Protection
Lycium ferocissimum	African Boxthorn	Yes	Asset Protection
Rubus fruticosus agg.	Blackberry	Yes	Asset Protection
Senecio madagascariensis	Fireweed	Yes	Asset Protection
Other weeds of regional concern			
Andropogon virginicus	Whisky Grass	No	Environment
Araujia sericifera	Moth Vine	No	Environment
Celtis australis	Nettle Tree	No	Environment
Cenchrus clandestinus	Kikuyu	No	Environment
Chloris gayana	Rhodes Grass	No	Environment
Eragrostis curvula	African Love Grass	No	Environment

Scientific Name	Common Name	WoNS	Biosecurity Act 2015
Gleditsia triacanthos	Honey Locust	No	Environment, Agriculture
Ligustrum lucidum	Broad-leaf Privet	No	Environment, Human Health
Phoenix canariensis	Phoenix Palm	No	Environment
Pyracantha crenatoserrata	Chinese Firethorn	No	Environment
Solanum mauritianum	Wild Tobacco	No	Environment, Agriculture

Agriculture: *animal and plant industries, including agriculture, horticulture, forestry, aquaculture, recreational and commercial fishing*

Asset protection: *These Weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets.*

Environment: *biodiversity of natural, urban and peri-urban environments (terrestrial and aquatic).*

**Refer to Greater Sydney Regional Strategic Weed Management Plan 2017 - 2022 for specific species legal requirements.*

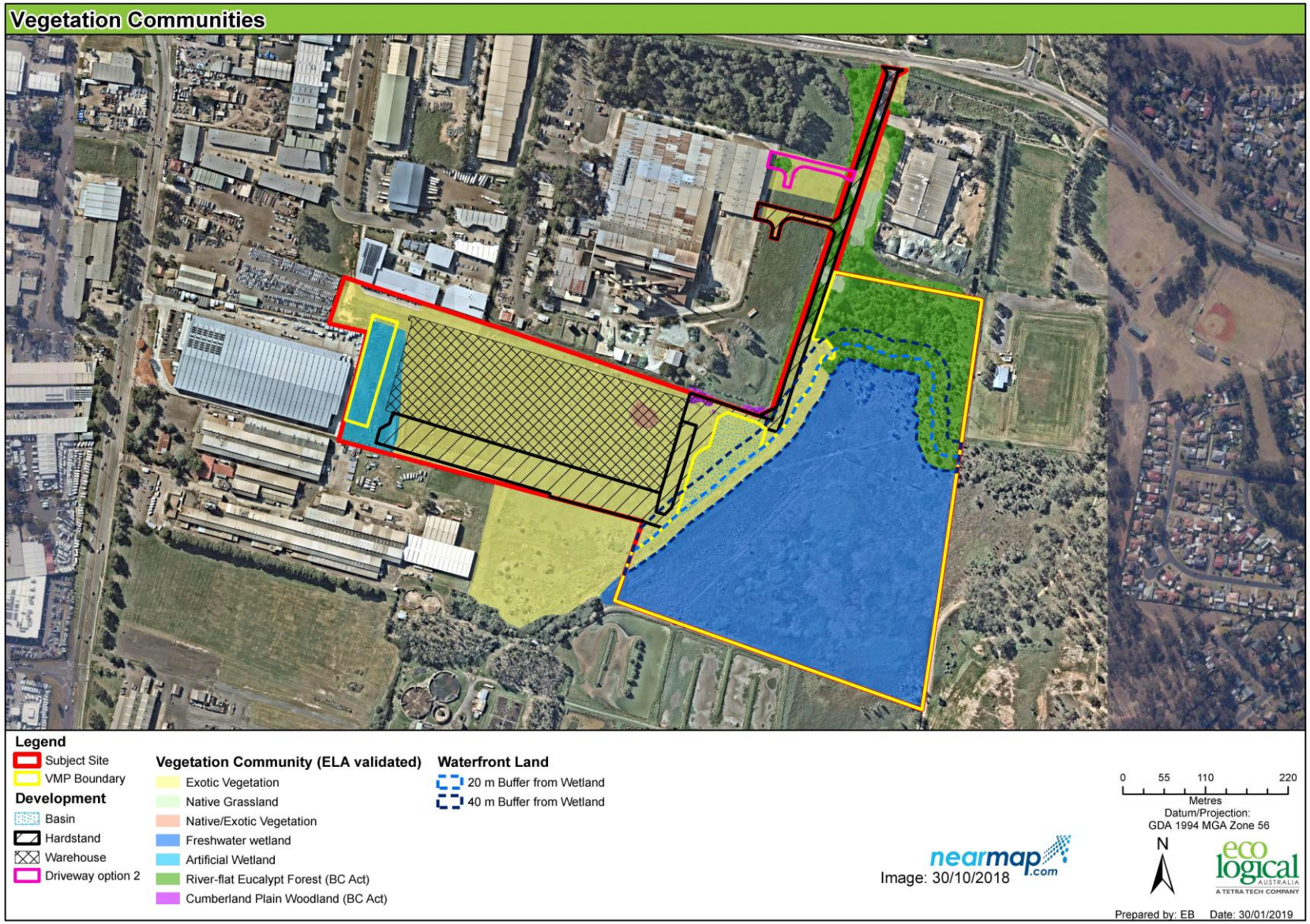

Figure 2: Vegetation communities within the VMP area

3 Construction and preliminary works

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

3.1 Fencing and signage

3.1.1 Temporary construction fencing

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 the project ecologist or a suitably qualified restoration ecologist or bush regenerator.

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

3.1.2 Soil and water management

Where revegetation is to occur in areas with no native regeneration potential, or areas subject to construction impacts the following actions will also be undertaken:

1. Strip the weedy vegetation and approximately 100mm mm of top soil
2. Stockpile topsoil and allow weed seed and exotic grass runners to germinate and spray with herbicide on at least two occasions
3. Re-apply topsoil
4. Rip and cultivate topsoil to ensure a soft, friable soil
5. Improve as required to achieve a locally appropriate soil (e.g. gypsum, trace minerals, etc.)

Soil preparation other than installation of jute matting/ mulch is to be undertaken by the civil contractor in consultation with the project restoration ecologist. The installation of jute matting/ mulch will be carried out during vegetation works by the bush regeneration contractor or under their supervision.

3.1.3 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.

3.1.4 Soil preparation

During all earthworks in the VMP area, i.e. for stormwater connections, the natural to soil is to be retained and returned to the area following works. Top soil will need to be a loose, friable soil free suitable for planting.

3.2 Pest control

Rabbits have potential to impede the success of the VMP. Any damage by rabbits, primarily due to grazing of young plants following revegetation works, may require rectification to successfully achieve the VMP performance criteria.

Pest control, if required, is to be undertaken in consultation with LLS.

3.3 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.

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, to the extent practicable:

- 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 burn 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 16.13 ha and encompasses the area to the east of the development area and surrounding the proposed driveway from Andrews Road. There are four management zones for this VMP (Figure 3):

- Zone 1: Revegetation - RFEF
- Zone 2: Regeneration - RFEF
- Zone 3: Priority Weed Control – FW
- Zone 4: Detention basins

4.1.1 Zone 1: Revegetation - RFEF

Zone 1 encompasses 0.56 ha of vegetation between the proposed development and Kingswood Park Wetland.

The vegetation throughout this zone is in poor condition with absent canopy and is dominated by exotic shrubs and groundcovers. Vegetation is primarily comprised herbaceous weeds including *Bidens pilosa* (Cobbler's Pegs), *Lactuca serriola* (Prickly Lettuce), *Onopordum acanthium* (Scotch Thistle) and *Senecio madagascariensis* (Fireweed), and exotic grasses including *Cenchrus clandestinus* (Kikuyu), *Cortaderia selloana* (Pampas Grass) and *Eragrostis curvula* (African Love Grass), with large patches of *Rubus fruticosus* agg. spp. (Blackberry) and isolated patches of shrub weeds including of *Gleditsia triacanthos* (Honey Locust) and *Pyracantha crenatoserrata* (Chinese Firethorn).

Herbaceous weeds and exotic grasses throughout this zone should be slashed and sprayed using a non-selective herbicide (e.g. Roundup Biactive®) in preparation for revegetation works. This will reduce competition on native plantings. Care must be taken to prevent off-target spraying of native groundcovers. The edge of the zone should be treated to prevent weed spread further into the intact areas of bushland.

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

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

4.1.2 Zone 2: Regeneration - RFEF

Zone 2 encompasses 3.06 ha of core riparian bushland to the north of Kingswood Park Wetland.

The vegetation throughout this zone is in moderate to good condition with intact native canopy, mid-storey and native groundcovers with interspersed patches of woody, vine and herbaceous weeds and exotic grasses. Weeds throughout this zone are primarily comprised of *Araujia sericifera* (Moth Vine), African Love Grass, Blackberry, *Cestrum parqui* (Green Cestrum), Fireweed, Honey Locust, *Senecio pterophorus* (African Daisy) and *Verbena bonariensis* (Purpletop).

Weed management works in this zone are to focus on the treatment of all weeds to promote further recruitment and regeneration native canopy, shrubs and groundcovers.

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

4.1.3 Zone 3: Priority weed control – FW

Zone 3 encompasses 11.36 ha of good condition Freshwater Wetland (Kingswood Park Wetland).

Vegetation throughout this zone is in good condition with high native resilience including intact native sedges and rushes. Weed cover throughout this zone is generally low with isolated patches of listed priority weeds, predominantly *Cortaderia selloana* (Pampas Grass).

Weed management works in this zone are to focus on the suppression of priority weeds, including targeted sweeps for *C. selloana.*

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

4.1.4 Zone 4: Detention basins

Zone 4 encompasses 1.16 ha of the proposed detention basins, which will be revegetated with hardy grass, sedge and rush species to help capture sediment and filter nutrients in stormwater run-off from the development area.

Once filtration media is installed, approximately 100% of this zone is expected to require revegetation to reinstate native FW and RFEF grass, sedge and rush species as identified in Table 3, with revegetation densities as identified in Table 4. All plantings need to be as per the recommended planting list included in **Appendix D**.

Species selection and placement will be dependent on the final design of the drainage basin. Grasses should be planted into drier areas throughout the basins, whereas sedges and rushes will be planted into areas of prolonged inundation.

4.1.5 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 revegetation. During these weed control activities, care must be taken to avoid impacting the natural regeneration of native species, which can be susceptible to trampling during on weed control works.

Primary and secondary weed control will include woody weed and vine weed control, specifically the control of *Cestrum parqui* (Green Cestrum), *Gleditsia triacanthos* (Honey Locust) and *Araujia sericifera* (Moth Vine). Juvenile *Araujia sericifera* plants can be hand-pulled, provided the whole root is removed. Large *C. parqui* plants can be treated using scrape and paint or drill and fill techniques. Large *A. sericifera plants* can be treated using the scrape and paint method. Chemical and mechanical control techniques will be required in follow up treatments. Follow up treatments of woody weeds including *C. parqui* seedling growth will be required.

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

4.1.6 Maintenance

Following secondary weed removal and revegetation, 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 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.

4.2 Revegetation

Revegetation works are required within Zone 1. It is expected that natural regeneration will occur within Zone 2 and Zone 3 following targeted weed removal.

Revegetation works will include planting of native groundcover, grass, shrub and canopy species using tube stock and Hiko / Viro cells.

Mulch, where needed, is to be applied providing a depth of 100mm. Mulch can be sourced from native vegetation earmarked for removed from the development area or externally sourced. Jute matting is to be used instead of mulch in areas of high erosional potential.

Planting densities for the management zones are provided in **Table 4**. A recommended planting list is provided **Appendix D**.

All plantings are to be sourced from local provenance stock, as per Florabank guidelines (Mortlock, 2000). More information on revegetation and seed collection specifications is provided in **Appendix C**.

Table 3: Planting assumptions and mulch requirements

Zone	Description	Total area (m²)	Reveg Area (%)	Reveg. area (m²)	Mulch (%)	Mulch area (m²)
1	Revegetation - RFEF	5,559	100%	5,559	100%	5,559
2	Regeneration - RFEF	30,556	-	-	-	-
3	Priority weed control - FW	113,624	-	-	-	-
4	Detention basins	11,573	100%	11,573	-	-
Total		***161,311***		***17,132***		***5,559***

Table 4: Revegetation densities

Zone	Description	Vegetation community	Reveg. area (m²)	Planting densities (per m^2)				Total numbers
				Trees	Shrubs	Herbs /Scramblers	Sedges / Grasses	
1	Revegetation - RFEF	RFEF	5,559	1/250	1/10	1	3	*22,814*
2	Regeneration - RFEF	RFEF	-	-	-	-	-	-
3	Priority weed control - FW	FW	-	-	-	-	-	-
4	Detention basins	FW & RFEF	11,573	-	-	2	4	*69,436*
Total			***17,132***	***22***	***556***	***28,704***	***62,968***	***92,250***

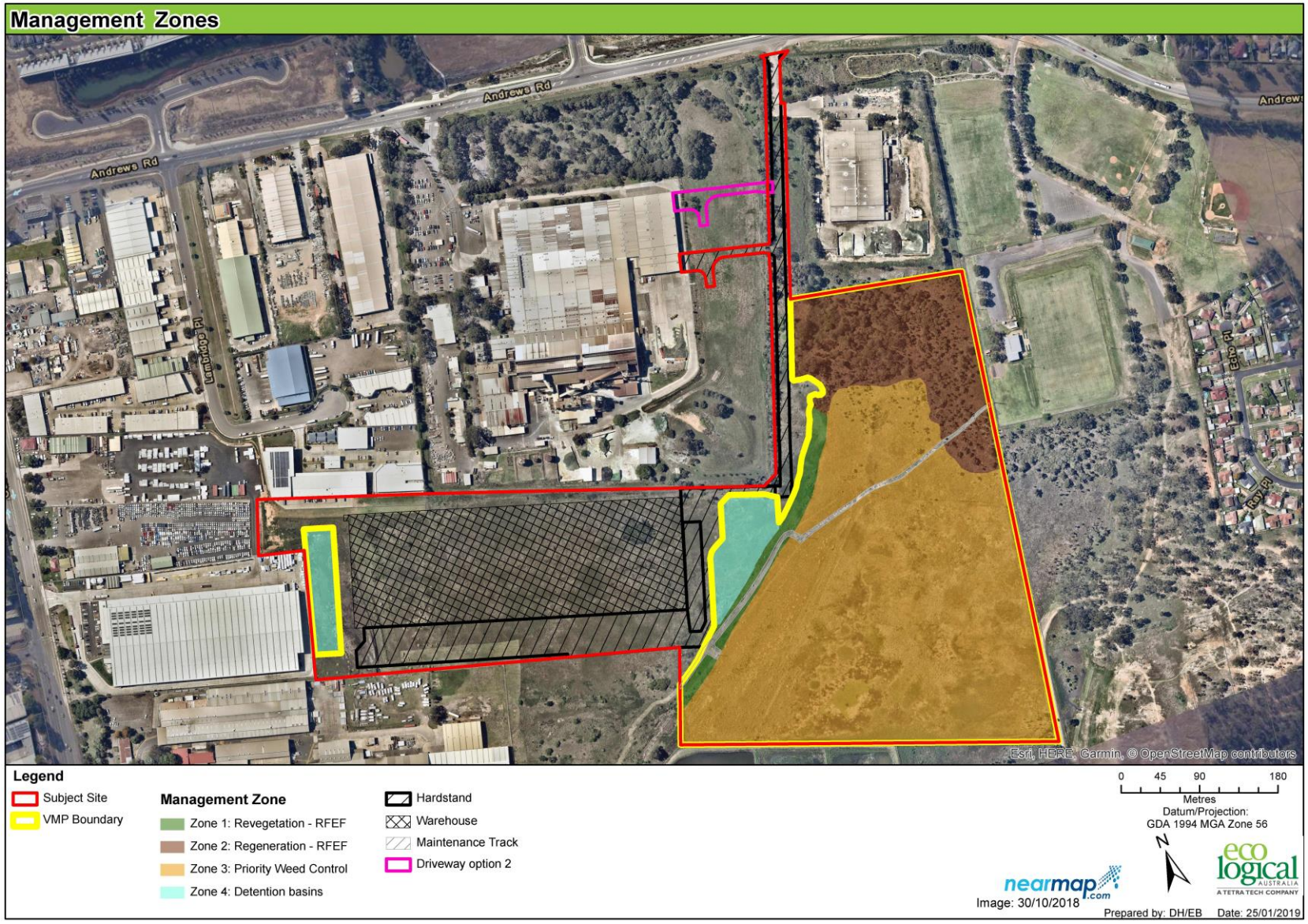

Figure 3: Vegetation management zones

5 Implementation schedule

5.1 Implementation schedule

The VMP area will be managed 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 a number of 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 PCC.

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 jute matting / mulch																				
Tubestock, supply and install																				
Replacement tubestock, supply and install																				
Irrigation																				
Weed control																				
Primary																				
Secondary																				
Maintenance																				
Other works																				
Monitoring and reporting																				

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 vegetation surveys and 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.

6.1.1 Photo monitoring

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 eight photo monitoring points within the VMP area, at least one in each zone
- 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 the second 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_190330 for a photo taken at the first photo monitoring point on the 30th March 2019).

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 PCC. 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 monitoring results to date
- a description of any problems encountered in implementing the works recommended in the 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 PCC 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. The civil contractor and the bush regeneration contractor, in consultation with PCC, can adapt these criteria as required in response to the success of rehabilitation works.

Table 6: Performance criteria

<table>
<tr><th>Management Zones</th><th>Year 1</th><th>Year 2</th><th>Year 3 – 4</th><th>Year 5</th></tr>
<tr><td rowspan="2">All Zones</td><td colspan="4">By the end of each year:
• 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 the project restoration ecologist or bush regenerator contractor
• Soil preparation works completed to specifications in Section 3.1.4
• All rubbish and debris removed
Vegetation management works:
• Revegetation undertaken with at least 50% of the species identified in Appendix D for each strata. Suitable substitute or additional species may be used where approved by the project restoration ecologist.
• A minimum of 85% survival rate of all vegetation strata planted in each zone (e.g. tree, shrub and groundcover)
• Where undertaken, 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 breakouts
• Monitoring and reporting undertaken in accordance with Section 6.</td></tr>
<tr><td>• Treat 100% of priority weeds
• Treat 95% of other weeds
• Treatment of new weed breakouts
• No more than 1m^2 of bare ground</td><td>• No greater than 15% cover by both priority and other weeds</td><td>• No greater than 10% cover by both priority and other weeds</td><td>• No greater than 2% cover by priority weeds
• No greater than 4% cover by other weeds</td></tr>
<tr><td>Zone 3: Priority weed control – Freshwater Wetland</td><td colspan="4">• Ongoing suppression of priority weeds
• No priority weeds allowed to set seed
• Treatment of new priority weed breakouts</td></tr>
</table>

7 Cost

The cost of implementation for five-year period is approximately **$605,000** 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 in regard to estimating costs have been outlined below.

7.1 Construction and preparation works

Civil construction activities are identified in **Table 5** 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 **$2,000** for a team of four 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 **93,000** plants will be required to achieve the densities identified in the VMP. The total estimated cost of revegetation is approximately **$255,000** for tubestock installation, including a 10% replacement rate.

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

The project restoration ecologist or other suitably qualified restoration ecologist or bush regeneration contractor 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

Table 7: Implementation costs

Treatment	Establishment	Maintenance				Total
	Year 1	Year 2	Year 3	Year 4	Year 5	
Revegetation						
Seed collection, cleaning, storage	$13,838	$0	$0	$0	$0	$13,838
Site Preparation	$8,566	$0	$0	$0	$0	$8,566
Jute Matting / Mulch	$13,898	$0	$0	$0	$0	$13,898
Tubestock, supply and install	$231,204	$0	$0	$0	$0	$231,204
Replacement tubestock, supply and install	$0	$23,120	$0	$0	$0	$23,120
Irrigation	$17,132	$0	$0	$0	$0	$17,132
Weed control						
Primary	$47,266	$0	$0	$0	$0	$47,266
Secondary	$18,330	$54,989	$0	$0	$0	$73,319
Maintenance	$0	$8,556	$34,224	$25,668	$17,112	$85,560
Associated costs						
Disbursements	$6,560	$6,355	$3,422	$2,567	$1,711	$20,614
Monitoring & Reporting	$14,061	$14,061	$14,061	$14,061	$14,061	$70,307
Totals	**$370,853**	**$107,082**	**$51,708**	**$42,296**	**$32,885**	**$604,823**

References

Bannerman, S.M. and Hazelton, P.A. 1990. Soil landscapes of the Penrith 1:100 000 Sheet. Soil Conservation Service of NSW, Sydney.

Brodie, L. 1999. *The National Trust Bush Regenerators Handbook*. National Trust of Australia (NSW).

Buchanan, R.A. 2000. *Bush regeneration: recovering Australian landscapes*. 2nd ed., TAFE NSW, Sydney.

Commonwealth Department of the Environment and Energy (DoEE 2004) *Catalogue of fence designs.* Online resource*:* https://www.environment.gov.au/system/files/resources/b39c119e-c58a-4473-9507-db68da31a95c/files/catalogue.pdf Accessed 12 November 2018.

Department of Infrastructure, Planning and Natural Resources (DoIPNR) 2003. *Bringing the bush back – Best practice guidelines for bush regeneration on the Cumberland Plain*. Online resource: http://www.aabr.org.au/images/stories/resources/manuals/bringing_the_bush_back.pdf Accessed 12 November 2018.

Eco Logical Australia 2018. *128 Andrews Road, Penrith – Flora and Fauna Assessment*. Prepared for Cadence Property Group Pty Ltd.

Hawksbury River County Council 2018. *Priority Weed List.* Online resource: http://hrcc.nsw.gov.au/weed-information/noxious-weed-list/ Accessed 12 November 2018.

Office of Environment and Heritage (OEH) 2013. *The Native Vegetation of the Sydney Metropolitan Area*. *Volume 2: Vegetation Community Profiles*. Version 2.0. NSW Office of Environment and Heritage, Sydney.

Mortlock, W. 2000*. The Hawkesbury-Nepean Catchment Management Authority (2000) Florabank Guideline 10: Seed collection ranges for revegetation*. Online resource: http://www.florabank.org.au/files/documents/Guideline%20No.%2010%20-%20Seed%20collection%20ranges%20for%20revegetation.pdf Accessed 12 November 2018.

NSW Department of Primary Industries – Water 2012. *Guidelines for riparian corridors on waterfront land*. Online resource: http://www.water.nsw.gov.au/__data/assets/pdf_file/0004/547222/licensing_approvals_controlled_activities_riparian_corridors.pdf Accessed 12 November 2018.

NSW Department of Primary Industries – Water 2012. *Working on waterfront land*. Online resource: https://www.water.nsw.gov.au/__data/assets/pdf_file/0009/547164/working-on-waterfront-land.pdf Accessed 12 November 2018.

Tozer, M. 2003. The native vegetation of the Cumberland Plain, *Western Sydney: systematic classification and field identification of communities*. Cunninghamia 8(1): 1-75.

Appendix A : Development Plan (Watson Young)

Appendix B : Existing vegetation species list

Scientific name	Common name
Native Species	
Acacia parramattensis	Parramatta Wattle
Acacia linifolia	White Wattle
Aristida vagans	Threeawn Speargrass
Bolboschoenus fluviatilis	Marsh club-rush
Carex appressa	Tall Sedge
Casuarina glauca	Swamp Oak
Centella asiatica	Centella
Cheilanthes sieberi subsp. *sieberi*	Mulga Fern
Cynodon dactylon	Common Couch
Dianella longifolia	Blueberry Lily
Dichondra repens	Kidney Weed
Echinopogon sp.	-
Eucalyptus amplifolia	Cabbage Gum
Eucalyptus crebra	Narrow-leaved Ironbark
Eucalyptus moluccana	Grey Box
Eucalyptus tereticornis	Forest Red Gum
Glycine clandestina	Twining Glycine
Juncus usitatus	-
Melaleuca armillaris	Bracelet Honey-myrtle
Melaleuca linariifolia	Flax-leaved Paperbark
Microlaena stipoides	Weeping Grass
Phragmites australis	Common Reed
Rytidosperma sp.	-
Typha orientalis	Broadleaf Cumbungi
Wahlenbergia gracilis	Sprawling Bluebell
Exotic Species	
Anagallis arvensis	Scarlet Pimpernel
Andropogon virginicus	Whisky Grass
Araujia sericifera	Moth Vine

Scientific name	Common name
Asparagus asparagoides	Bridal Creeper
Asphodelus fistulosus	Onion Weed
Bidens pilosa	Cobblers Pegs
Biflora testiculata	Carrot Weed
Briza subaristata	-
Celtis australis	European Nettle Tree
Cenchrus clandestinus	Kikuyu
Cestrum parqui	Green Cestrum
Chloris gayana	Rhodes Grass
Cirsium vulgare	Spear Thistle
Conyza bonariensis	Fleabane
Cortaderia selloana	Pampas Grass
Cynodon dactylon	Couch
Eragrostis curvula	African Love Grass
Foeniculum vulgare	Fennel
Gleditsia triacanthos	Honey Locust
Hypochaeris radicata	Cat's Ears
Lactuca serriola	Prickly Lettuce
Ligustrum lucidum	Broad-leaved Privet
Lycium ferocissimum	African Boxthorn
Modiola caroliniana	Red-flowered Mallow
Morus alba	Mulberry
Onopordum acanthium	Scotch Thistle
Paspalum dilatatum	Paspalum
Phoenix canariensis	Phoenix Palm
Plantago lanceolata	Plantain
Polypogon monspeliensis	Annual Beardgrass
Pyracantha crenatoserrata	Chinese Firethorn
Rubus fruticosus agg.	Blackberry
Rumex sp.	Dock
Senecio madagascariensis	Fireweed
Senecio pterophorus	African Daisy
Setaria sp.	Pigeon Grass

Scientific name	Common name
Sida rhombifolia	Paddy's Lucerne
Solanum mauritianum	Tobacco Weed
Solanum nigrum	Blackberry Nightshade
Solanum sisymbriifolium	Sticky Nightshade
Sonchus oleraceus	Common Sowthistle
Stenotaphrum secundatum	Buffalo Grass
Trifolium repens	White clover
Verbena bonariensis	Purpletop
Vicia spp.	Vetch

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 *Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum), *and Pennisetum clandestinum* (Kikuyu 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 *Sida rhombifolia* (Sida) and *Lantana camara* (Lantana) will be controlled by the cut 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 *Cardiospermum grandiflorum* (Balloon 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

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 or watercart used 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 Cumberland Plain of Sydney. Wetland species are to be collected from within the Cumberland Plain component of the Hawkesbury Nepean Catchment.

Where species identified in this VMP cannot be sourced, they may be substituted for other Cumberland Plains Woodland species as identified by Tozer (2003). 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 PCC.

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.

Appendix D : Recommended planting list

Form	Scientific Name	Common Name	Zones 1, 2 & 3	Zone 4	
				Drier Areas	Wetter Areas
Trees	*Acacia parramattensis*	Parramatta Wattle	X		
	Angophora floribunda	Rough-barked Apple	X		
	Eucalyptus amplifolia subsp. *amplifolia*	Cabbage Gum	X		
	Eucalyptus tereticornis	Forest Red Gum	X		
Shrubs	*Acacia floribunda*	White Sally Wattle	X		
	Bursaria spinosa subsp. *spinosa*	Native Blackthorn	X		
	Phyllanthus similis	-	X		
Grasses & groundcovers	*Adiantum aethiopicum*	Maidenhair Fern	X		
	Brunoniella australis	Blue Trumpet	X		
	Centella asiatica	Centella	X		
	Cheilanthes sieberi subsp. sieberi	Mulga Fern	X		
	Commelina cyanea	Scurvy Weed	X		
	Desmodium varians	Slender Tick-trefoil	X		
	Dichondra repens	Kidney Weed	X		
	Echinopogon ovatus	Forest Hedgehog Grass	X		
	Einadia hastata	Berry Saltbush	X		
	Entolasia marginata	Bordered Panic	X		
	Hemarthria uncinata	Matgrass		X	X
	Imperata cylindrica	Blady Grass	X	X	

Form	Scientific Name	Common Name	Zones 1, 2 & 3	Zone 4	
				Drier Areas	Wetter Areas
	Lachnagrostis filiformis	-	X	X	
	Microlaena stipoides var. *stipoides*	Weeping Grass	X		
	Oplismenus aemulus	Australian Basket Grass	X		
	Oxalis perennans	-	X		
	Paspalum distichum	Water Couch		X	X
	Plectranthus parviflorus	Cockspur Flower	X		
	Poranthera microphylla	-	X		
	Pratia purpurascens	Whiteroot	X		
	Solanum prinophyllum	Forest Nightshade	X		
	Wahlenbergia gracilis	Sprawling Bluebell	X		
Vines & climbers	*Clematis glycinoides* var. *glycinoides*	Headache Vine	X		
	Geitonoplesium cymosum	Scrambling Lily	X		
	Glycine clandestina	Twining Glycine	X		
	Glycine tabacina	-	X		
	Polymeria calycina	-	X		
	Rubus parvifolius	Native Raspberry	X		
Sedges & rushes	*Baumea articulata*	Jointed Twig-rush			X
	Baumea rubiginosa	Twig-rush			X
	Bolboschoenus caldwellii	Club-rush			X
	Bolboschoenus fluviatilis	Marsh Club-rush			X

Form	Scientific Name	Common Name	Zones 1, 2 & 3	Zone 4	
				Drier Areas	Wetter Areas
	Carex appressa	Tall Sedge	X	X	
	Eleocharis acuta	Common Spike Sedge			X
	Eleocharis sphacelata	Tall Spike-rush	X		X
	Ficinia inundata	Swamp Club-sedge	X		X
	Fimbristylis dichotoma	Common Fringe-sedge			X
	Juncus usitatus	-	X	X	X
	Lomandra longifolia	Spiny-headed Mat-rush	X		

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