Vegetation Management Plan

El Caballo Blanco and Gledswood Estates (ECBG) Golf Course

Prepared for
Sekisui House Camden Valley Pty Ltd

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Contents

1 Introduction 1
1.1 Background 1
1.2 Objectives of the VMP 1

2 Description of the environment 2
2.1 Location 2
2.2 Regional context 2
2.3 Historical significance 2
2.4 Existing vegetation 2
2.4.1 Vegetation communities 2
2.4.2 Weed species 3

3 Management Works 6
3.1 Revegetation 6
3.2 Vegetation management zones 12
3.2.1 Zone 1: Dense Woodland 12
3.2.2 Zone 2: Grassland - recreate 13
3.2.3 Zone 3: Grassland - retain 14
3.2.4 Zone 4: Open Woodland – recreate extensive 15
3.2.5 Zone 5: Open Woodland – recreate moderate 16
3.2.6 Zone 6: Open Woodlands - retain 17
3.2.7 Zone 7: Raingarden / riparian areas 18
3.2.8 Zone 8: Dams 19
3.3 Other Management Works 20
3.3.1 Site mark out / construction fencing 20
3.3.2 Soil and water management 20
3.3.3 Seed collection 20
3.3.1 Management of weed waste 20
3.3.2 Earthworks 20
3.3.3 Removal of livestock and pest control 21
3.3.4 Asset Protection Zone (APZ) installation 21
3.3.5 Salinity Management 21
3.3.6 Adaptive management 21

4 Staging & responsibility of works 22
4.1 Staging 22
4.1.1 Preliminary phase 22
Pre-construction 22

Construction 22
4.1.2 Establishment phase 22
4.1.3 Maintenance phase 23
4.2 Implementation schedule 23
4.3 Responsibility 23

5 Monitoring and reporting 25

6 Implementation Cost 29

References 33

Appendix A Noxious Weed Categories 34

Appendix B Techniques and specifications 35

Appendix C Revegetation species list 38

Appendix D Landscape Plan 44

List of figures

Figure 1: ECBG Golf Course VMP area 4
Figure 2: Vegetation communities 5
Figure 3: Management Zones - overview 8
Figure 4: Management Zones - North 9
Figure 5: Management Zones - Middle 10
Figure 6: Management Zones - South 11

List of tables

Table 1: Noxious weed list 3
Table 2: Revegetation strategy 7
Table 3: Revegetation densities 7
Table 4: Indicative implementation schedule 24
Table 5: Performance criteria 27
Table 6: Indicative implementation costs 30
Table 7: Revegetation costs including direct seeding 31
Table 8: Indicative annual cost breakdown 32

Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
CNAP	Conservation of Natural Assets Policy
CPW	Cumberland Plain Woodland
DA	Development Application
DS	Direct Seeding
DCP	Development Control Plan
ELA	Eco Logical Australia
ECBG	El Caballo Blanco and Gledswood estates
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
FFA	Flora and Fauna Assessment
LGA	Local Government Area
SHCV	Sekisui House Camden Valley Pty Ltd
SMP	Salinity Management Plan
TS	Tubestock
TSC Act	NSW *Threatened Species Conservation Act 1995*
VMP	Vegetation Management Plan
VMS	Vegetation Management Strategy
VPA	Voluntary Planning Agreement

1 Introduction

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Sekisui House Camden Valley Pty Ltd (SHCV) for the restoration of Cumberland Plains Woodlands (CPW) surrounding the proposed golf course within the El Caballo Blanco and Gledswood (ECBG) release area precincts. The site is located within the Camden Local Government Area (LGA).

1.1 Background

A Vegetation Management Strategy (VMS) was prepared by ELA in 2011 to accompany a Voluntary Planning Agreement (VPA) as part of the rezoning for the ECBG site. The VMS objectives were formed around the Camden Council's Conservation of Natural Assets Policy (CNAP) which was in place at the time of rezoning but is no longer applied by Council. The VMS is predicated on offsetting and re-creation to mitigate vegetation losses from development. This strategy and its targets became embedded in the precinct vegetation management objectives and controls of the Camden Development Control Plan (DCP).

The VMS identifies a total requirement of 42.87 ha of retained and recreated vegetation for conservation within the ECBG area. This requirement has been revised to 36.46 ha after taking into account the revised development footprint and the DCP's required offset ratio for areas identified as loss in the VMS which are now being conserved (sC12.10.12).

The total area to be conserved in the ECBG area is 36.34 ha. The Riley's Creek VMP (ELA 2015) included 7.9 ha of offset, or approximately 22% of the revised VMS target. This VMP includes the remaining 28.44 ha of offset or approximately 78% of the revised VMS target.

The VMS also identifies areas of 'rough' around each fairway which will be revegetated to Cumberland Plain (Shale Hills / Shale Plains) Woodland communities to rehabilitate habitat corridors throughout the site. The vegetation management of the golf course 'roughs' have not been included in this VMP or in the VMS calculations as the required VMS target has already been achieved. However, it is recommended that these areas are managed in a way that is sympathetic to the native vegetation adjacent in order to increase success and decrease costs within the conservation areas.

1.2 Objectives of the VMP

The objectives of this VMP are to provide a guide to bush regeneration contractors to:

- protect and regenerate remnant vegetation in the conservation area
- control noxious and environmental weeds on the subject land
- revegetate Cumberland Plain Woodland (CPW) providing a habitat corridor for connectivity of wildlife habitats
- protect flora and fauna habitat

2 Description of the environment

2.1 Location

The VMP area is located within the ECBG estates in the suburb of Gledswood Hills. The VMP area is located to the south east of Camden Valley Way, west of the Gledswood Homestead and Winery, south of the Camden Lakeside Country Club and north of Country Club Camden Valley (**Figure 1**). The Riley's Creek management area, as detailed in the Riley's Creek VMP (ELA 2015) is located to the east of the golf course area (**Figure 1**).

2.2 Regional context

The development is located largely on a large grazing property in what was the El Caballo Estate and surrounding the Gledswood Homestead. Some areas of native vegetation are present within the local area, however significant areas have been historically disturbed by pastoral works.

2.3 Historical significance

The Gledswood estate, including the Gledswood homestead, outbuildings and adjoining rural landscapes are considered historically significant as they remain substantially intact from the 19th century. The Gledswood House Historic Area (GHHA) is:

- Listed as an item of State environmental heritage under the Camden Local Environmental Plan, 2010 (CLEP 2010) (Item 81)
- Listed on the State Heritage Register (SHR) (Item 01692) under the NSW Heritage Act, 1977
- Subject to a Conservation Management Plan (CMP) developed by Godden Mackay Logan (GML)
- Listed (as Catherine Field) as a classified place on the heritage register of the National Trust of Australia (NSW) (Britton, 2015)

This VMP is meant to be read in conjunction with the Heritage Impact Assessment report (HIA) prepared by Geoffrey Britton in July 2015. Canopy plantings will be installed throughout the GHHA as directed by Landscape drawings within the HIA.

2.4 Existing vegetation

Flora mapping has been assessed on multiple occasions by ELA with the latest version of the relevant vegetation communities produced as part of the FFA in July 2015 (**Figure 2**).

2.4.1 Vegetation communities

The native vegetation community; Cumberland Plain Woodland (CPW) has been identified within the VMP area (**Figure 2**). This vegetation community is listed as Critically Endangered Ecological Community under the NSW Threatened Species Act 1995 (TSC Act) and as Critically Endangered under the Commonwealth Environmental Protection and Biodiversity Conservation 1999 (EPBC Act).

Cumberland Plains Woodland occurs across the site as Shale Hills Woodland and Shale Plains Woodland (**Figure 2**). CPW onsite is characterised by a native canopy cover of mainly *Eucalyptus crebra, Eucalyptus moluccana* and *Eucalyptus tereticornis*. The shrub layer is denuded throughout much of the site due to previous management activities in particular grazing; however in identified woodland areas to be retained *Acacia decurrens* and *Bursaria spinosa* are present. Native groundcovers occur within the Derived Native Grasslands (DNG), within many of the woodland areas,

and are present scattered throughout the site, particularly underneath native canopy trees. Typical species include *Aristata ramosa, Aristata vagans, Austrodanthonia caespitosa, Dichondra repens, Microlaena stipoides* var. *stipoides, Paspalidium distans* and *Themeda australis*.

2.4.2 Weed species

A total of 24 weed species were recorded within the site including five class 4 noxious weeds: *Araujia sericifera* (Moth Vine), *Lantana camara* (Lantana), *Lycium ferocissimum* (African Boxthorn) *Opuntia stricta* (Common Prickly Pear) and *Senecio madagascariensis* (Fireweed). All five species are declared noxious weeds in the Camden Local Control Authority under the NSW Noxious Weeds Act 1992 (**Table 1)**.

Table 1: Noxious weed list

Scientific name	Common name	Noxious weed category
Araujia sericifera	Moth Vine	4
Axonopus filiformis	Narrow-leafed carpet grass	
Bidens pilosa	Cobblers Peg	
Chloris gayana	Rhodes Grass	
Cirsium vulgare	Spear Thistle	
Cynodon dactylon	Couch Grass	
Ehrharta erecta	Panic Veldt grass	
Eragrostis curvula	African Love Grass	
Lantana camara	Lantana	4
Lycium ferocissimum	African Boxthorn	4
Melinis repens	Red Natal Grass	
Olea europaea subsp. cuspidata	African Olive	
Onopordum acanthium	Scotch Thistle	
Opuntia stricta	Prickly pear	4
Paspalum dilatatum	Paspalum	
Pennisetum clandestinum	Kikuyu	
Plantago lanceolata	Ribbed Plantain	
Senecio madagascariensis	Fireweed	4
Setaria sp.	Pigeon grass	
Sida rhombifolia	Paddy's Lucerne	
Stenotaphrum secundatum	Buffalo grass	
Sonchus oleraceus	Sow thistle	
Sporobolus africanus	Parramatta grass	
Verbena bonariensis	Purpletop	

Note - Noxious weed categories are shown in **Appendix A**

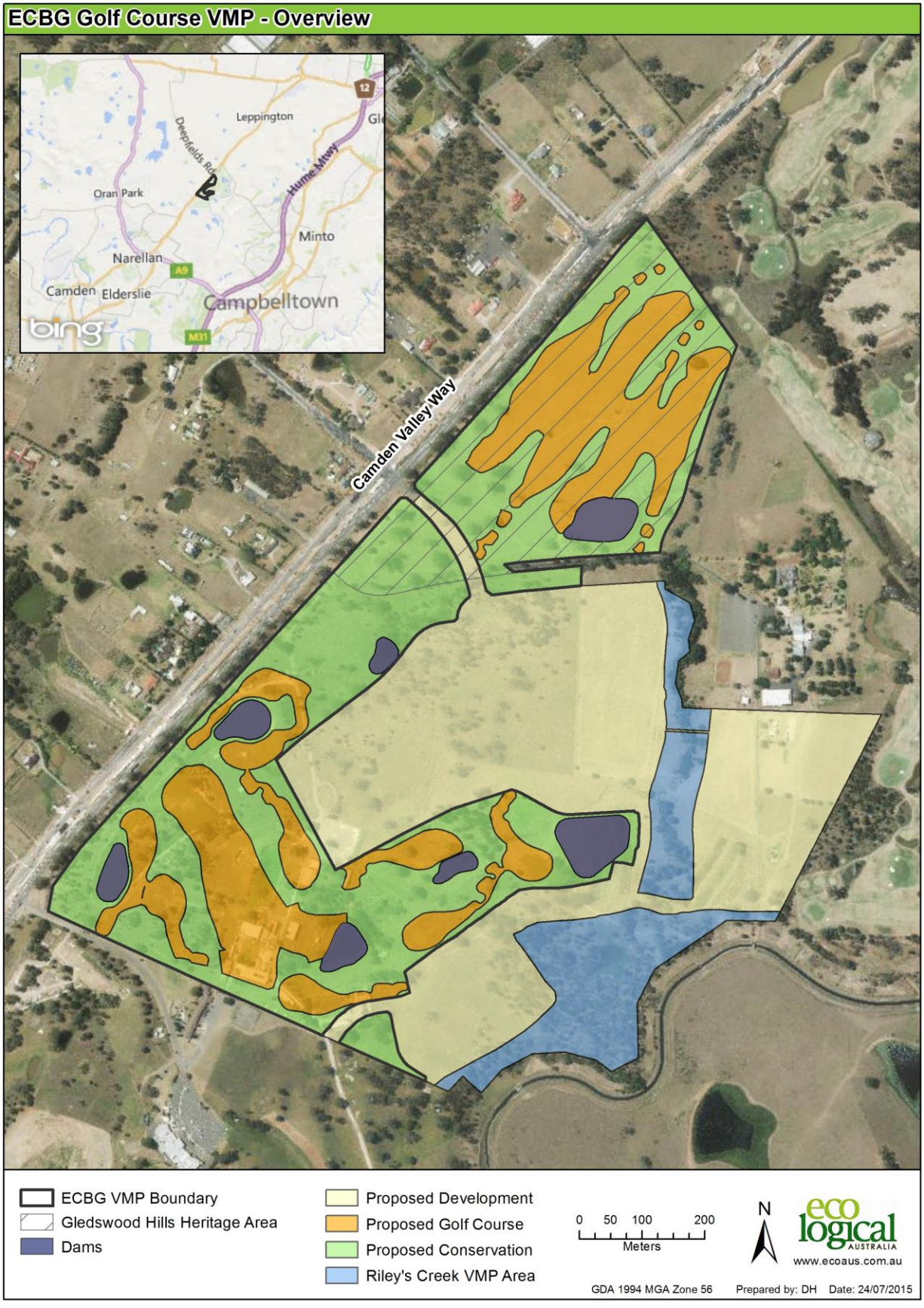

Figure 1: ECBG Golf Course VMP area

Figure 2: Vegetation communities

3 Management Works

The VMP area has been divided into three vegetation management types to identifying target community goal, specifically, Dense Woodland (DW), Grassland (GL) and Open Woodland (OW).

The current condition of vegetation across the site is greatly varied, ranging from good quality woodland or derived native grasslands through to highly disturbed areas. Highly disturbed areas will require re-creation activities whilst areas in better condition are expected to be retained.

Dense woodlands will be re-created to include native canopy, a dense mid-storey and ground cover species. Grasslands will be re-created or retained with no native canopy or mid-layer shrubs, although existing canopy trees will be retained. Open woodlands will be re-created or retained to include native canopy and ground covers but will have limited amounts of native shrubs in the mid-layer.

The VMP will be implemented by a suitably qualified bush regeneration contractor (**Appendix B**).

The vegetation management zones are shown in **Figure 3** to **Figure 6**.

3.1 Revegetation

Revegetation will be required across a number of zones. This will be undertaken using tubestock planting, broadscale direct seeding and niche direct seeding. Each of these techniques should be undertaken as per **Appendix B**.

The breakdown of revegetation type within each zone is shown in **Table 2**.

Revegetation densities and total plants required are identified in **Table 3**.

Table 2: Revegetation strategy

Zone	Description	Sum of Area (m^2)	Revegetation Area (%)	Revegetation area (m^2)	DS Proportion (%)	TS Proportion (%)	DS Area (m^2)	TS Area (m^2)
1	Dense Woodland	24,787	95	23,548	-	100	-	23,548
2	Grassland - recreate	97,050	90	87,345	100	-	87,345	-
3	Grassland - retain	15,341	10	1,534	-	100	-	1,534
4	Open Woodland - recreate extensive	45,201	95	42,941	90	10	38,646	4,294
5	Open Woodland - recreate moderate	40,513	75	30,385	50	50	15,192	15,192
6	Open Woodland - retain	22,987	10	2,299	-	100	-	2,299
7	Raingarden / riparian areas	9,435	100	9,435	-	100	-	9,435
8	Dams	29,465	5	1,473	-	100	-	1,473
Total		**284,779**	**70**	**198,959**	**71**	**28**	**141,184**	**56,302**

Table 3: Revegetation densities

Zone	Description	Revegetation Area (m2)	Total plant number requirements				
			Tree	Shrub	Herbs / Scramblers	Sedge / Grass	*Total*
1	Dense Woodland	23,548	1/25m^2	1/6m^2	1/m^2	3/m^2	*99,057*
2	Grassland - recreate	87,345	-	-	1/m^2	3/m^2	*349,379*
3	Grassland - retain	1,534	-	-	1/m^2	3/m^2	*6,136*
4	Open Woodland - recreate extensive	42,941	1/200m^2	1/50m^2	1/m^2	3/m^2	*172,836*
5	Open Woodland - recreate moderate	30,385	1/200m^2	1/50m^2	1/m^2	3/m^2	*122,298*
6	Open Woodland - retain	2,299	1/200m^2	1/50m^2	1/m^2	3/m^2	*9,252*
7	Raingarden / riparian areas	9,435	-	-	1/m^2	5/m^2	*56,612*
8	Dams	1,473	-	-	1/m^2	5/m^2	*8,840*
Totals	**-**	198,959	***1,320***	***5,437***	***198,959***	***618,694***	***824,410***

Figure 3: Management Zones - overview

Figure 4: Management Zones - North

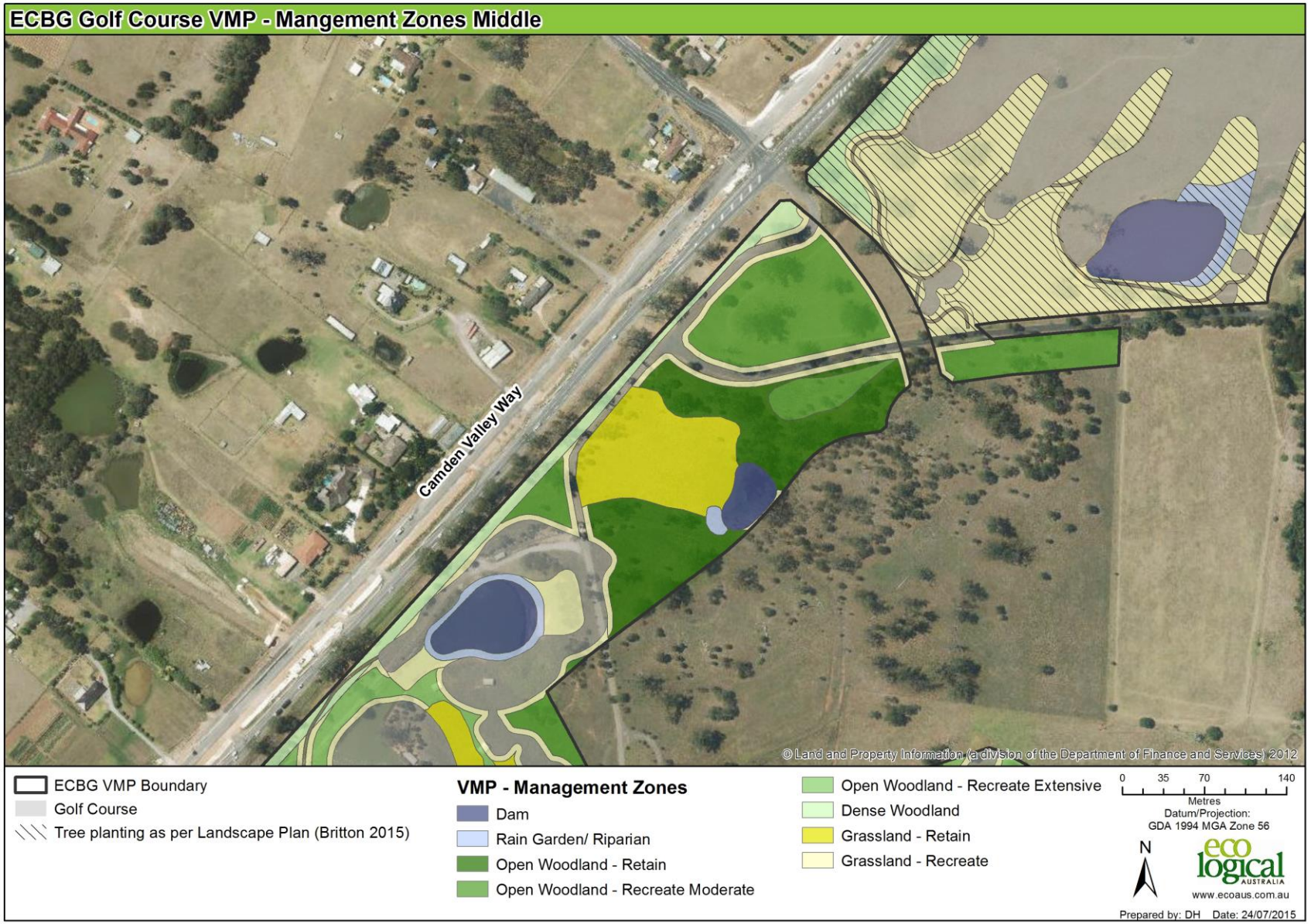

Figure 5: Management Zones - Middle

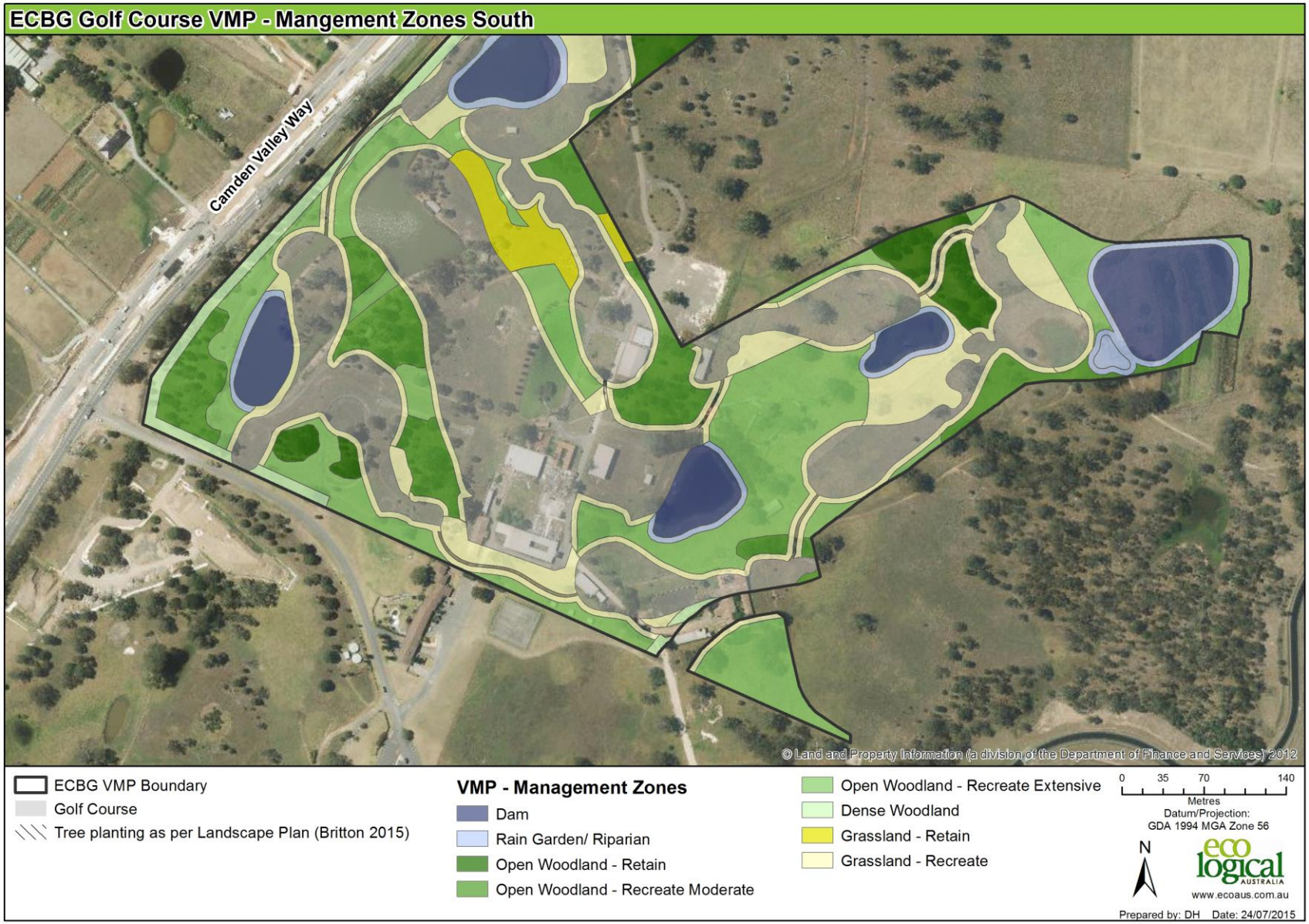

Figure 6: Management Zones - South

3.2 Vegetation management zones

The Golf Course VMP Conservation Area has a total area of 28.46 ha.

Proposed management works are identified below for each zone, with further details provided in **Appendix B**.

3.2.1 Zone 1: Dense Woodland

Zone 1, an area of 2.48 ha, comprises a buffer along the Camden Valley Road, which will be re-created to dense woodlands to provide a vegetative buffer to the road.

The majority of the zone is in highly disturbed condition, with significant weed infestations, particularly the exotic grass species *Pennisetum clandestinum* (Kikuyu grass) and *Chloris gayana* (Rhodes grass). However, within the zone there are pockets of native vegetation expected to exhibit some native resilience (the ability to regenerate from disturbance) particularly the woodland remnants around the existing dam in the south east corner of the zone and areas of native grasses, mainly *Aristata* spp. within the northern section of the site.

Site preparation

The area will be sprayed and then mulched. Underneath existing woodland and within native grassland, weeds in the ground layer will be hand weeded and spot sprayed to prevent overspray of native groundcovers and promote native groundcover regeneration.

Revegetation

Revegetation will be undertaken in the establishment phase using tubestock as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**.

Maintenance

Once installed plants will need continual visual monitoring and re-watering as required to ensure survival.

Weed levels will need to be kept low across the zone to ensure plantings can establish without competition from weed species. Maintenance to be conducted is to include initial preparation works undertaken by hand to ensure weeds around plantings are removed so that follow up treatments do not damage plantings. Follow up works to be undertaken by either brush cutting prior to seed set, spot spraying or hand weeding.

3.2.2 Zone 2: Grassland - recreate

Zone 2, an area of 9.70 ha, comprises a number of areas to be converted to native grassland including fairway and walking path edges. Note that all existing canopy trees will be retained.

Within the portion of the GHHA detailed in **Figure 4**, the plantings canopy species will be required as identified and located in the HIA (Britton 2015). The overview map of this document and the relevant species is provided in **Appendix D**.

Site preparation

This zone will be either sprayed or scraped (removal of the top layer of existing groundcover) depending on factors such as slope, accessibility, vegetation present. Spraying will occur on numerous occasions to ensure death of weeds.

Revegetation

Revegetation will be undertaken in the establishment phase using broadscale direct seeding as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**.

Maintenance

After seeding, this zone will need continual visual monitoring and re-watering as required to ensure survival.

Weed levels will need to be kept low across the zone to ensure plantings can establish without competition from weed species. Within this area, annual/perennial herbaceous weeds will be sprayed with a dicot specific herbicide as this will not affect the germination of native grass seeds. Maintenance of exotic grasses will need to be undertaken using a combination of hand removal, slashing/brush cutting prior to seed and careful spot spraying away from native grasses.

3.2.3 Zone 3: Grassland - retain

Zone 3, an area of 1.53 ha contains derived native grasslands in moderate to good condition which will be retained as native grasslands.

Weed control

Weed levels will need to be kept low across the zone in order to allow native grasses to establish and consolidate within the area. Initial weed control works will target all exotic grasses in particular *Pennisetum clandestinum* (Kikuyu grass) and *Paspalum dilatatum* (Paspalum) and annual/perennial herbaceous weeds such as *Bidens pilosa* (Cobblers peg) and *Cirsium vulgare*.

Exotic grasses in these areas will need to be aggressively targeted for removal from this area. If native grasses are not seeding, initial control works may be undertaken by slashing / brush cutting down all vegetation, including native and weedy grasses which will enable for more accurate identification of exotic weed grasses. Provided native grasses are not seeding, slashing is not expected to cause long term damage to native grasses, and in many species this action mimics the natural disturbance regime either by fire or grazing, stimulating native grass growth. It is vital that slashing machinery does not have exotic weed seed present.

All other weeds, including annual/perennial dicot weeds will be sprayed with a dicot specific herbicide, which will not affect the native grasses.

Revegetation

Niche seeding will be undertaken in this zone during the preliminary management phase.

Revegetation will be undertaken in the establishment phase using tubestock as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**.

Maintenance

Works will include ongoing maintenance of all emerging weeds to allow native grasses to establish and consolidate. Once the weed seed bank has been reduced and native grasses are well established they are expected to be able to largely exclude weed germination.

All exotic grasses will continue to be controlled primarily by hand weeding. All other weeds including all emerging annual/perennial herbaceous weeds will be controlled using a combination of hand weeding, brush cutting and spot spraying with a dicot specific herbicide.

In order to maintain the area as native grassland, all emerging native canopy or shrubs will be assessed prior to the end of the establishment period, as they may require removal to retain the area as grassland. This will be undertaken preferably by translocation but if not possible they will need to be controlled by scrape/cut and painting.

All plantings will be watered as required to allow establishment. Left over native grass seed from direct seeding or ‘incidental’ seed which becomes available will be hand spread throughout these areas.

3.2.4 Zone 4: Open Woodland – recreate extensive

Zone 4, an area of 4.52 ha, comprises a number of highly disturbed areas to be converted to open woodland.

Site preparation

These areas will be largely be scraped back (removal of the top layer of existing groundcover). In some areas, for example around the bases of native trees, weedy groundcovers will be sprayed, on at least two occasions. Areas that are identified as not being able to be direct seeded will be mulched.

Revegetation

Revegetation will be undertaken in the establishment phase using broadscale direct seeding as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**. Where hydro-seeding is not able to be achieved or where it is unsuccessful, tubestock plantings will be installed.

Maintenance

After seeding and planting, the areas will need continual visual monitoring and re-watering as required to ensure survival.

Weed levels will need to be kept low across the zone to ensure plantings can establish without competition from weed species. Herbicide application will be restricted in these areas in order not to harm germinating native dicot shrubs and canopy species. Accordingly maintenance weed control will be undertaken largely by hand removal until native shrubs are well established.

3.2.5 Zone 5: Open Woodland – recreate moderate

Zone 5, an area of 4.05 ha, comprises a number of areas which range in condition, which generally lack a native shrub or groundcover but retain native canopy trees, these areas will be converted to open woodland. .

Site preparation

Weedy groundcovers in particularly *Pennisetum clandestinum* (Kikuyu) will all be sprayed using non selective herbicides, on at least two occasions. These areas may be slashed, then weeds allowed to re-grow, as spraying new growth increases the herbicide uptake of many weed species. Areas that are identified as not being able to be direct seeded will be mulched.

Where possible, these areas will receive translocated topsoil/native seed material from clearance works within the development footprint.

Revegetation

Niche seeding will be undertaken in this zone during the preliminary management phase.

Revegetation will be undertaken in the establishment phase using broadscale direct seeding as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**. Where hydro-seeding is not able to be achieved or where it is unsuccessful, tubestock plantings will be installed.

Maintenance

After seeding and planting, the areas will need continual visual monitoring and re-watering as required to ensure survival.

Weed levels will need to be kept low across the zone to ensure plantings can establish without competition from weed species. Herbicide application will be restricted in these areas in order not to harm germinating native dicot shrubs and canopy species. Accordingly maintenance weed control will be undertaken largely by hand removal until native shrubs are well established.

3.2.6 Zone 6: Open Woodlands - retain

Zone 6, an area of 2.30 ha contains woodlands in moderate to good condition which will be retained as open woodlands. These areas often retain elements of all structural vegetation components in varying condition including canopy trees, shrubs and groundcovers.

Weed control

Weed levels will need to be kept low across the zone, particularly prior to seed set in order to allow native shrubs and grasses to establish and consolidate within the area. Initial weed control works will target all exotic grasses in particular *Pennisetum clandestinum* (Kikuyu grass) and annual/perennial herbaceous weeds such as *Bidens pilosa* (Cobblers peg).

Exotic grasses in these areas will need to be aggressively targeted for removal from this area. If native grasses are not seeding, initial control works may be undertaken by slashing / brush cutting down all vegetation, including native and weedy grasses which will enable for more accurate identification of exotic weed grasses. Provided native grasses are not seeding, slashing is not expected to cause long term damage to native grasses, and in many species this action mimics the natural disturbance regime either by fire or grazing, stimulating native grass growth

All woody or vine weeds present will be controlled by cut/scrape and painting, hand weeding or spot spraying. All annual/perennial dicot weeds will be sprayed with a dicot specific herbicide, which will not affect the native grasses.

Where possible, these areas will receive translocated topsoil/native seed material from clearance works within the development footprint.

Revegetation

Niche seeding will be undertaken in this zone during the preliminary management phase.

Revegetation will be undertaken in the establishment phase using broadscale direct seeding as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**.

Maintenance

Works will include ongoing maintenance of all emerging weeds to allow natives to establish and consolidate. Once the weed seed bank has been reduced and native grasses are well established they are expected to be able to largely exclude weed germination.

All exotic grasses will continue to be controlled primarily by hand weeding. All other weeds including all emerging annual/perennial herbaceous weeds will be controlled using a combination of hand weeding, brush cutting and spot spraying with a dicot specific herbicide.

All plantings will be watered as required to allow establishment. Left over native grass seed from direct seeding or 'incidental' seed which becomes available will be hand spread throughout these areas.

3.2.7 Zone 7: Raingarden / riparian areas

Zone 7, a total area of 0.94 ha, includes the two proposed rain garden / bioretention basins to be installed and maintained in the Golf Course VMP area. Riparian areas will include the banks and edges of the dams and water course areas and the riparian area between the dam and Rileys Creek in the GHHA.

Installation – rain gardens

These will initially be used as sediment basins during the construction stage. Once their use as a sediment basin is complete and the biofiltration media has been installed, these basins will revegetated. As mulch or jute matt can compromise the effectiveness of the biofiltration media, neither will be installed. Intense weed control will therefore be required to prevent weed establishment in these areas. During the construction phase, weed control will be undertaken to ensure that no new vegetation species established. It is recommended that sediment fencing is installed and maintained at all inlets to the rain gardens until the native vegetation has established.

Revegetation

Revegetation will be undertaken in the establishment phase using a modified FW community focusing on hardy sedge and grass species. Revegetation will be undertaken using tubestock as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**.

Maintenance

Once installed plants will need continual visual monitoring and re-watering as required to ensure survival.

Weed levels will need to be kept low across the zone to ensure plantings can establish without competition from weed species. Maintenance to be conducted is to include initial preparation works undertaken by hand to ensure weeds around plantings are removed so that follow up treatments do not damage plantings. Follow up works to be undertaken by either brush cutting prior to seed set, spot spraying or hand weeding.

3.2.8 Zone 8: Dams

Zone 8, a total area of 2.95 ha, includes the ponds / dams into which aquatic species will be installed.

Site preparation

It is expected that as part of the construction works the dams will be modified to include a stepped edge for planting of aquatic plants around the edges of these dams.

Revegetation

Revegetation will be undertaken in the establishment phase using a modified FW community focusing on aquatic species. Revegetation will be undertaken using tubestock as per the strategy identified in **Table 2** to achieve the densities identified in **Table 3**.

Maintenance

Once installed plants will need continual visual monitoring and re-watering as required to ensure survival. Follow up works to be undertaken by hand weeding using waders.

3.3 Other Management Works

The developer shall be responsible for ensuring the following tasks are undertaken within the timeframes outlined below.

3.3.1 Site mark out / construction fencing

Prior to construction works commencing the developer shall undertake surveying and pegging out the locations of all planned infrastructure including golf fairways and walking paths.

The developer shall be responsible for the installation of all construction fencing to ensure construction activates do not impact onto conservation areas. Construction fencing is required to identify the boundary between construction activities and vegetation management works and around trees to be retained in the construction area. The aim of this is to prevent unnecessary damage to native vegetation in the VMP area from construction activities and excludes all construction machinery, activities, materials and staff from the VMP area. The developer shall also be responsible for the removal of all construction fencing before the end of the establishment period.

3.3.2 Soil and water management

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. Sediment fencing may be attached to construction fencing described in **Section 3.3.1**.

3.3.3 Seed collection

Prior to construction works commencing within the proposed development footprint, collection of propagative materials (including seeds, cuttings) and transplantation should be undertaken, aiming to collect as much propagation material as possible. A longer period will achieve better outcomes for the site. For example within some of the areas to be cleared a dense understorey of the native grass *Microlaena stipoides* is present, collection of as much seed as possible will reduce the need for buying seed for direct seeding and infill seeding projects, saving costs and achieving the best ecological outcome possible for the site.

All seed collection must be undertaken using Flora bank Seed Collection guidelines, a Section 132C licence under the NSW *National Parks and Wildlife Act 1974* will be required to undertake seed collection works as outlined in **Appendix B**.

3.3.1 Management of weed waste

All woody weed material will be mulched on site, piled into unobtrusive piles or disposed of at a facility licensed to receive green waste. All weed propagules especially noxious 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.

3.3.2 Earthworks

During the construction phase when clearing areas of existing vegetation, earthworks and tree removal should be undertaken with a trained ecologist or bush regenerator to supervise works. It is expected that in several areas, top soil with native seed will be re-useable within the VMP area.

All timber should be retained onsite, with mulch stockpiled for use within conservation areas, all viable seed collected and all timber cut into logs to be utilised as habitat for native fauna.

3.3.3 Removal of livestock and pest control

It is expected that prior to the commencement of VMP works, all livestock will be removed from all conservation areas.

Prior to and following the revegetation works, pest control must take place. Evidence of European rabbits (*Oryctolagus cuniculus*) including fresh diggings, faeces and burrows were observed onsite, particularly in the SCA. Control methods may include shooting, trapping, fumigation or fencing, but this will need to be determined following the creation of an index to assess rabbit numbers and in consultation with Camden City Council. The most appropriate method of control will need to be decided upon and enacted before plantings are installed to prevent plant losses.

3.3.4 Asset Protection Zone (APZ) installation

Asset Protection Zones (APZ) will need to be established within the conservation corridor as per guidelines established in ELA's 2015 'Bushfire Protection Assessment: Proposed subdivision – El Caballo Blanco' report. Note that the revegetation of grassland, which does not have a shrub layer, is expected to likely meet APZ requirements.

3.3.5 Salinity Management

Where salinity is observed, management of the soil will be required to address this issue prior to VMPO works. Where sodic soils are identified, management should consist of capping the upper surfaces, as per the SMP (Douglas Partners 2015). However, in cases where this is not possible, management will consist of (Douglas Partners 2015):

> *Sodic soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. The addition of organic matter, gypsum and lime can also be considered where appropriate. After gypsum addition, reduction of sodicity levels may require some time for sufficient infiltration and leaching of sodium into the subsoils, however capping of exposed sodic material should remain the primary management method. Topsoil added at the completion of bulk earthworks is, in effect, also adding organic matter which may help infiltration and leaching sodium".*

Where plants replacement is required these will be comprised of more salt tolerant species such as *Casuarina glauca* and other species identified in **Appendix C**.

3.3.6 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 for advanced direct seeding techniques in place of manual planting techniques.

The success of the works will be determined by meeting the performance criteria (**Table 5**). 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 change to performance criteria must be approved in writing by Camden Council.

4 Staging & responsibility of works

4.1 Staging

The implementation of this VMP is expected to be undertaken over a period of ten years, divided into three phases: preliminary, establishment and maintenance.

4.1.1 Preliminary phase

The preliminary works are sub-divided into pre-construction and construction.

Pre-construction

Expected to occur from August 2015 to July 2016, this period will commence when on ground restoration works commence and continue until onsite construction works commence.

The focus of works within this period will be the collection of as much seed material as possible for revegetation from within areas to be cleared and on the seeding, site preparation and weed control of areas considered to have higher levels of resilience or native regeneration potential.

Construction

Expected to occur from August 2016 to July 2017, this period commences at the start of construction works and continues until construction works are complete, including construcition of roads, pathways, amenities and golf courses.

The focus of works within this period will be to supervise earthworks for direct seeding areas and to translocate seed / topsoil from within cleared areas into conservation areas, as well as the continued site preparation / mulching of all areas.

4.1.2 Establishment phase

Expected to occur from May 2017 to April 2010, this phase commences at the completion of construction works and continue for a minimum of three years (years three to five of the project).

The focus of works within this period will be the installation and maintenance of all the revegetation including direct seeding and tubestock plantings. These are expected to be given the following priority / timing:

- Year 3. Tubestock planting and direct seeding of
  - Zone 1 (Dense Woodlands)
  - Zone 2 (Grassland re-create)
  - Zone 4 (Open Woodland – recreate extensive).
  - Zone 7 (Raingarden/ riparian)
  - Zone 8 (Dams)
- Year 4. Tubestock planting and direct seeding of
  - Zone 5 (Open Woodland – recreate moderate)
- Year 5. Tubestock planting of
  - Zone 3 (Grassland – retain)
  - Zone 6 (Open Woodland – retain)

4.1.3 Maintenance phase

Following the completion of the Establishment phase, the maintenance phase will be undertaken of a period of five years, proposed to last from May 2020 to April 2025. It is expected that this element will be managed by the golf course operators.

4.2 Implementation schedule

An indicative implementation schedule is included **Table 4**.

Note that all dates included in the table are based off current proposed construction times. Timing of the restoration / revegetation works can be amended to suit construction works, however it is expected that works are undertaken over the full ten years. Likewise the timing of revegetation is indicative, meant to show the proposed staging of revegetation works over the five years of the establishment period.

4.3 Responsibility

The developer shall be responsible for ensuring all activities marked as Construction activities are undertaken within timeframes identified in **Table 4**.

All vegetation management works have been costed out and identified in **Table 4**. The key to the table is provided below.

Key	Construction activities	
	Vegetation management works	

Table 4: Indicative implementation schedule

Zone	Treatment	Preliminary								Establishment								Maintenance																			
		Pre-construction				Construction				Operations																													
		Year 1 (FY 15/16)				Year 2				Year 3				Year 4				Year 5				Year 6				Year 7				Year 8				Year 9				Year 10			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
All zones	Site mark out / construction fencing																																								
	Soil and water management																																								
	Seed Collection																																								
	Earthworks																																								
	Supervision of Earthworks																																								
	Removal of livestock																																								
	Pest control																																								
	APZ installation																																								
	Salinity Management																																								
	Reporting																																								
Zone 1: Dense Woodlands	Site preparation																																								
	Mulching																																								
	Tubestock installation																																								
	Establishment weed control																																								
	Replacement planting																																								
	Maintenance weed control																																								
Zone 2: Grassland - recreate	Site preparation																																								
	Direct Seeding																																								
	Establishment weed control																																								
	Maintenance weed control																																								
Zone 3. Grassland - retain	Preliminary weed control																																								
	Establishment weed control																																								
	In-fill planting																																								
	Maintenance weed control																																								
Zone 4: Open Woodland - recreate extensive	Site preparation																																								
	Mulching																																								
	Direct Seeding																																								
	Tubestock installation																																								
	Establishment weed control																																								
	Replacement planting																																								
	Maintenance weed control																																								
Zone 5: Open Woodland - recreate moderate	Preliminary weed control																																								
	Site preparation																																								
	Mulching																																								
	Direct Seeding																																								
	Tubestock installation																																								
	Establishment weed control																																								
	Replacement planting																																								
	Maintenance weed control																																								
Zone 6. Open Woodland - retain	Preliminary weed control																																								
	Establishment weed control																																								
	In-fill planting																																								
	Maintenance weed control																																								
Zone 7: Raingardens / riparian areas	Site preparation																																								
	Tubestock installation																																								
	Establishment weed control																																								
	Maintenance weed control																																								
Zone 8: Dams	Site preparation																																								
	Tubestock installation																																								
	Establishment weed control																																								
	Maintenance weed control																																								

5 Monitoring and reporting

Monitoring and reporting are both extremely important. 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.

5.1 Monitoring

Monitoring will be undertaken by vegetation surveys and photo monitoring. Monitoring will need to be undertaken prior to works being commenced to establish a benchmark for performance. Monitoring results will occur on a 6-monthly basis for the establishment phase (Year 3 to Year 5), then annually in late November / early December for the long-term (Year 6 to Year 10).

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 one photopoint for each management zone except for Zone 7 and Zone 8;
- mark the photo point with a six foot star picket at the south-west corner and map the location of each photo point using GPS;
- take a digital photo of each photo point at each of the compass points with the the star picket visible in the photo to act as a reference point and towards the north-east corner;
- organise the digital photos logically with each image labelled with a unique reference number indicating the location of the photo point and the date the photo is taken.

At each photopoint, the following monitoring data will be gathered 6-monthly for the first five years (Autumn and Spring):

- One full floristic vegetation quadrat (20 m x 20 m). This shape can be modified given the limited width of some zones (e.g. Zone 4)
- One, 30 minute diurnal bird survey site (undertaken within two hours of sunrise, temperature range between 20ºC and 25ºC)
- One anabat recording site (one hour recording immediately after sunset. Temperature to be between 25ºC and 30ºC)
- One 50m x 20m plot to measure hollows and fallen logs

In addition to the above, a traverse of all reaches is to be undertaken annually, and after a one in five year rain event to identify any erosion points, weed infestations or other management issues. The

temperature ranges provided above are indicative only and depending on seasonal conditions surveys may occur on cooler days.

Monitoring results will be included in Progress Reports (**Section 5.2**).

5.2 Progress reports

Progress reporting will occur on a 6 monthly basis for the establishment phase (Year 3 to Year 5), then annually in late November / early December for the long-term (Year 6 to Year 10). This reporting includes the implementation of the monitoring actions specified in **Section 5.1**. In addition to a description of the works that have been undertaken, this report should be structured to address the following questions:

- What environmental threats have been reduced?
- What environmental improvements have been achieved?
- What tasks have been successful?
- What has not been successful?
- What measures, if any, have been taken to rectify problems?
- What issues need to be addressed?
- What are the outcomes of the management activities?
- Recommendations for revising the task program, if necessary

An independent qualified environmental practitioner, appointed by the landowner, will audit the monitoring program every two years

5.3 Performance criteria

The performance criteria required for the site and to be assessed every 6 months are listed in **Table 5.** The performance criteria listed are compatible with the VMS requirements. If monitoring indicates that the VMP tasks are not resulting in achievement of the performance criteria, the task program will be revised. The bush regeneration contractor, in consultation with Camden Council, can adapt these criteria as required in response to the success of rehabilitation works.

Where non-performance occurs and is not immediately rectified a ‘stop the clock’ notice on the maintenance period will be issued by Camden Council until the non-performance is rectified.

Table 5: Performance criteria

Applicable to	Preliminary		Establishment phase		Maintenance	
	Pre- construction: End of Year 1	Construction: End of Year 2	Post construction End of Year 3:	Post construction End of Year 5	Maintenance End of Year 6 to 8	Maintenance: End of Year 9 to10
All zones	Management tasks implemented according to schedule or evidence of planning for their implementation. A demonstrated increase in native cover and diversity and a demonstrated decrease in exotic cover and diversity					
Zones 1, 2, 4, 7, 8	-		80% of all adult woody weeds to be controlled No plants allowed to set seed and all seeding individuals removed No establishment of new noxious or woody species	All regrowth to be maintained to no greater than 20% coverage No plants allowed to set seed No establishment of new noxious or woody species	All regrowth to be maintained to no greater than 5% coverage No plants allowed to set seed No establishment of new noxious or woody species	Complete eradication from the site
	-		Maximum exotic groundcover no greater than 50% of each zone	Maximum exotic groundcover no greater than 30% of each zone	Maximum exotic groundcover covers no greater than 20% of each zone	Maximum exotic groundcover covers no greater than 10% of each zone
	-		Minimum native vegetation groundcover no less than 20% of each zone	Minimum native vegetation groundcover no less than 50% of each zone	Minimum native vegetation groundcover no less than 60% of each zone	Minimum native vegetation groundcover no less than 70% of each zone

Applicable to	Preliminary		Establishment phase		Maintenance	
	Pre- construction: End of Year 1	Construction: End of Year 2	Post construction End of Year 3:	Post construction End of Year 5	Maintenance End of Year 6 to 8	Maintenance: End of Year 9 to10
Zones 2, 5, 6	80% of all adult woody weeds to be controlled No plants allowed to set seed and all seeding individuals removed No establishment of new noxious or woody species		All regrowth to be maintained to no greater than 10% coverage No plants allowed to set seed No establishment of new noxious or woody species		All regrowth to be maintained to no greater than 5% coverage No plants allowed to set seed No establishment of new noxious or woody species	Complete eradication from the site
	Maximum exotic groundcover covers no greater than 50%		Maximum exotic groundcover covers no greater than 40%	Maximum exotic groundcover covers no greater than 30%	Maximum exotic groundcover covers no greater than 10%	Maximum exotic groundcover covers no greater than 5%
	Minimum native vegetation groundcover no less than 20% of each zone		Minimum native vegetation groundcover no less than 30% of each zone	Minimum native vegetation groundcover no less than 50% of each zone	Minimum native vegetation groundcover no less than 60% of each zone	Minimum native vegetation groundcover no less than 70% of each zone
Revegetation areas	A minimum of 85% survival rate of all revegetation, including of each strata Installation of all plants, all direct seeding, all top soil translocation and all replacement planting Any localised plant failure within planting areas are addressed with no area larger than 2 m x 2 m without surviving plants 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.					

6 Implementation Cost

The cost to implement restoration works detailed in this VMP is estimated at approximately **$4,600,000** (ex GST) as outlined in **Table 6**. This includes the installation of revegetation numbers detailed in **Table 7.** An indicative annual cost breakdown, based on the implementation schedule provided in **Table 4** is shown in **Table 8**.

These costings have been provided to SHCV in order for them to be able to quantify works required on this site using ELA's commercial rates. As such, ELA requests that these figures not be provided to a third party, e.g. tenderers, without the knowledge or approval of ELA.

The cost of all civil works (e.g. stripping of vegetation from revegetation areas, installation of fencing, etc.) has not been included in this VMP. These works are assumed to be included in the civil works contract.

6.1 Regeneration

Weed control and regeneration works have been calculated at $2,000 for a team of four bush regenerators per day. The cost of bush regeneration works includes travel and the costs of herbicide, vehicles and equipment which are required to implement the proposed works.

6.2 Revegetation

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. The majority of the site will be revegetated via tubestock. Tubestock costs have been budgeted at an estimated $2.5 per tree and shrub including planting, water crystals, fertiliser and initial watering, and an estimated $1.75 per grass, sedge and groundcover including planting, water crystals and initial watering. Some zones will be revegetated via direct seeding in an integrated mulch matrix. An example of this product is Ecoblanket® which has been estimated at $9/m^2. It should be noted that this cost is based on the current rate for a specific product and if the product or rate changes, this cost may need to be updated.

A total of 825,000 plants will be required to achieve the densities identified in the VMP, including approximately 258,000 tubestock and the remainder in direct seeding. The total estimated cost of revegetation is approximately $1,270,000 for direct seeding and $505,000 for tubestock installation, including a 10% replacement rate (**Table 7**). These proportions may change in the future depending on the site conditions.

Increases in regeneration from niche seeding and the translocation of plants and from within the development footprint may reduce the revegetation requirements. Some assumptions in relation to the success of niche seeding have been factored into these costs. The actual amount of revegetation required will need to be assessed at the end of the preliminary phase.

6.3 Monitoring and reporting

All monitoring, mapping and reporting works have been calculated using the rate for a qualified and trained Restoration Ecologist of $150 / hr.

Table 6: Indicative implementation costs

Treatment	Unit Costs for Treatment Zones								Total
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	
Total Area	*15,475*	*88,476*	*15,472*	*53,343*	*58,837*	*23,177*	*534*	*29,465*	*284,779*
Revegetation									
Seed collection, cleaning, storage - Years 1-2	$14,858	$52,407	$920	$25,925	$18,345	$1,388	$8,492	$1,326	$123,662
Site Preparation - Year 3-5	$11,774	$43,672	$767	$21,470	$15,192	$1,149	$4,718	$737	$99,479
Jute Matting / Mulch -Years 3-5	$158,710	$-	$9,971	$28,040	$99,206	$15,011	$-	$-	$310,938
Direct Seeding, supply and install - Years 3-5	$-	$786,103	$-	$347,818	$136,731	$-	$-	$-	$1,270,652
Tubestock, supply and install - Years 3-5	$179,432	$-	$10,738	$30,380	$107,486	$16,263	$99,072	$15,469	$458,841
Replacement tubestock, supply and install - Years 4-6	$17,943	$-	$1,074	$3,038	$10,749	$1,626	$9,907	$1,547	$45,884
Irrigation	$17,661	$-	$1,151	$3,221	$11,394	$1,724	$7,077	$1,105	$43,332
Weed control									
Preliminary - Years 1-2	$-	$-	$30,681	$-	$81,026	$45,974	$-	$-	$157,681
Establishment - Years 3-5	$123,934	$485,249	$30,681	$226,003	$81,026	$45,974	$47,177	$58,931	$1,098,975
Maintenance - Years 5-10	$74,361	$291,149	$30,681	$135,602	$121,539	$45,974	$28,306	$88,396	$816,008
Associated costs									
Supervision of earthworks - Year 2	$2,479	$9,705	$-	$4,520	$-	$-	$944	$2,947	$20,594
Monitoring & Reporting - Years 1-10	$11,154	$43,672	$6,903	$20,340	$18,231	$10,344	$4,246	$13,259	$128,150
Waste Costs - Years 1-10	$4,957	$19,410	$3,068	$9,040	$8,103	$4,597	$1,887	$5,893	$56,956
Totals	**$617,263**	**$1,731,367**	**$126,636**	**$855,398**	**$709,027**	**$190,027**	**$211,825**	**$189,609**	**$4,631,152**

Table 7: Revegetation costs including direct seeding

Zone	Description	Direct Seed (m2)	Tubestock (m2)	Tubestock requirements					DS Cost	TS Cost	TS Replacement cost	**Total**
				Tree	Shrub	Herbs / Scramblers	Sedge / Grass	*Total*				
1	Dense Woodland	-	23,548	942	3,925	23,548	70,643	99,057	$-	$179,432	$17,943	$197,375
2	Grassland - recreate	87,345	-	-	-	-	-	-	$786,103	$-	$-	$786,103
3	Grassland - retain	-	1,534	-	-	1,534	4,602	6,136	$-	$10,738	$1,074	$11,812
4	Open Woodland - recreate extensive	38,646	4,294	21	86	4,294	12,882	17,284	$347,818	$30,380	$3,038	$381,237
5	Open Woodland - recreate moderate	15,192	15,192	76	304	15,192	45,577	61,149	$136,731	$107,486	$10,749	$254,966
6	Open Woodland - retain	-	2,299	11	46	2,299	6,896	9,252	$-	$16,263	$1,626	$17,890
7	Raingardens	-	9,435	-	-	9,435	47,177	56,612	$-	$99,072	$9,907	$108,979
8	Dams	-	1,473	-	-	1,473	7,366	8,840	$-	$15,469	$1,547	$17,016
Totals	**-**	**141,184**	**56,302**	**1,051**	**4,360**	**57,775**	**195,143**	**258,330**	**$1,270,652**	**$458,841**	**$45,884**	**$1,775,377**

Table 8: Indicative annual cost breakdown

Treatment	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Revegetation											
Seed collection, cleaning, storage - Years 1-2	$43,282	$43,282	$24,732	$12,366		$-	$-	$-	$-	$-	$123,662
Site Preparation - Year 3-5	$-	$-	$82,371	$15,192	$1,916	$-	$-	$-	$-	$-	$99,479
Jute Matting / Mulch -Years 3-5	$-	$-	$186,750	$99,206	$24,982	$-	$-	$-	$-	$-	$310,938
Direct Seeding, supply and install - Years 3-5	$-	$-	$1,133,921	$136,731	$-	$-	$-	$-	$-	$-	$1,270,652
Tubestock, supply and install - Years 3-5	$-	$-	$324,353	$107,486	$27,002	$-	$-	$-	$-	$-	$458,841
Replacement tubestock, supply and install - Years 4-6	$-	$-		$32,435	$10,749	$2,700	$-	$-	$-	$-	$45,884
Irrigation	$-	$-	$29,063	$11,394	$2,875	$-	$-	$-	$-	$-	$43,332
Weed control											
Preliminary - Years 1-2	$78,841	$78,841	$-	$-	$-	$-	$-	$-	$-	$-	$157,681
Establishment - Years 3-5	$-	$-	$366,325	$366,325	$366,325	$-	$-	$-	$-	$-	$1,098,975
Maintenance - Years 5-10	$-	$-	$-	$-	$-	$244,802	$244,802	$122,401	$122,401	$81,601	$816,008
Associated costs											
Supervision of earthworks - Year 2	$-	$20,594	$-	$-	$-	$-	$-	$-	$-	$-	$20,594
Monitoring & Reporting - Years 1-10	$3,845	$2,563	$19,223	$19,223	$19,223	$12,815	$12,815	$12,815	$12,815	$12,815	$128,150
Waste Costs - Years 1-10	$5,696	$5,696	$5,696	$5,696	$5,696	$5,696	$5,696	$5,696	$5,696	$5,696	$56,956
Totals	**$131,662**	**$150,975**	**$2,172,433**	**$806,054**	**$458,766**	**$266,013**	**$263,313**	**$140,912**	**$140,912**	**$100,111**	**$4,631,152**

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Appendix A Noxious Weed Categories

Management zone	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be eradicated from the land and the land must be kept free of the plant.
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	The plant must be fully and continuously suppressed and destroyed.*

Appendix B 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 in all management zones. 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.

Exotic grasses

Exotic grasses, such as *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.

Annual / perennial herbaceous weeds

Where individual plants are found, and where intermixed with native groundcovers they will be hand pulled or slashed prior to flowering. Where large swaths of these species occur or where intermixed only with native grasses they will be sprayed using a 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 spot sprayed 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.

Woody weeds

Woody weeds onsite in particular *Lantana camara* (Lantana), *Lycium ferocissimum (Afircan Boxthorn)* and *Olea europaea* subsp. *cuspidata.* (African Olive) 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, 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.

Herbicide use

The use of herbicide to control weeds should be carefully considered. Herbicide use should assess potential long-term impacts of the technique including whether the proposed works actually 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 to control 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. If herbicides are required to be used near waterways, a glyphosate-based herbicide formulated for use near waterways will be used (e.g. RoundUp© Biactive™).

Broad-leaf selective herbicide may be used as per the *Noxious and environmental weed control handbook* (DPI 2010). 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 *Pesticide Regulation 2009*.

Revegetation

Revegetation has the aims of re-establishing the original native vegetation community at the site, creating habitat for flora and fauna and reducing erosion.

Niche seeding will be undertaken by hand spreading native seed in small areas of low resilience surrounded by larger areas of higher resilience. The local provenance native seed mix will be as per the groundcover species identified in **Appendix C**.

Broadscale direct seeding will be undertaken using 'Ecoblanket' or equivalent. Ecoblanket is a pneumatically-applied mulch and seed mixture which also contains fertiliser, soil improvers and a tackifier to suppress weed growth, control erosion and provide a suitable growing medium for seeds. The local provenance native seed mix will be as per the groundcover species identified in **Appendix C** to achieve the required densities. An exotic cover crop can be used, however this must be sterile. Following hydro-seeding event/s Ecoblanket will be irrigated regularly for a period of at least 6 months or until establishment of native seed, whichever is longer. Where irrigation is not able to be set up; the areas will be watered manually until grasses are thoroughly established.

Tubestock revegetation will be undertaken using tubestock of hiko cells 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 rootball. 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 rootball and no air

pockets are left. This will be required unless sufficient rainfall (approx 10mm) occurs on the day of planting.

Tree guards may 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. 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.

Mulch should be used where identified. The use of mulch is very important because it provides organic matter to the top soil, improves soil structure and aeration, water infiltration, nutrient availability, and is also useful in the suppression of weed growth (Buchanan 2009). Mulch should be sourced from within the local area. Mulch must be free of weed propagules and invasive woody species such as Coral Tree (*Erythrina x sykesii*). Mulching should not be undertaken within areas of high potential erosion. It is recommended jute matting is used in these areas prior to revegetation.

Plants should be installed in spring or autumn months, to take advantage of suitable weather conditions for planting. A maximum rate of attrition of 10% is to be tolerated, with any plant loss above this rate to be replaced at the contractor's expense.

Provenance plant / seed supply

Any plantings or native seed to be utilised should consist of suitable provenance stock. Current research suggests that seed sourcing should concentrate less on 'local' collection and more on capturing high quality and genetically diverse seed in order to maximise the adaptive potential of restoration efforts to current and future environmental change. Florabank's collection guidelines reflect this emerging understanding and advise that, while seed should be collected as locally as possible, the matching of environmental conditions at the planting site with those of the collection location is the most important consideration in establishing the collection range.

Recommended species have been provided in **Appendix C**.

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 or fulfil the membership criteria. 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 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 C Revegetation species list

Type	Scientific name	Common name	Zones 1 - 6		Zone 7	Zone 8	Saline Areas
			CPW	AW	FW/ AW	FW	
Tree Canopy Species (>10m)	*Angophora bakeri*	Narrow-leaved Apple	X				
	Angophora floribunda	Rough-barked Apple	X	X			
	Angophora subvelutina	Broad-leaved Apple	X	X			
	Brachychiton populneus	Kurrajong					
	Casuarina glauca	Swamp Oak		X			X
	Corymbia maculata	Spotted Gum	X				
	Eucalyptus amplifolia	Cabbage Gum	X	X			
	Eucalyptus baueriana	Blue Box	X	X			
	Eucalyptus crebra	Narrow-leaved ironbark	X				
	Eucalyptus eugenioides	Thin-leaved Stringybark	X				
	Eucalyptus moluccana	Grey Box	X	X			
	Eucalyptus tereticornis	Forest Red Gum	X	X			
Small Trees / Tall shrub Species (1.5m-10m)	*Acacia decurrens*	Sydney green wattle	X				
	Acacia floribunda	White Sally	X	X			
	Acacia parramattensis	Parramatta wattle	X	X			

Type	Scientific name	Common name	Zones 1 - 6		Zone 7	Zone 8	Saline Areas
			CPW	AW	FW/ AW	FW	
	Acacia implexa	Lightwood	X				
	Breynia oblongifolia	Coffee bush		X			
	Bursaria spinosa	Blackthorn	X	X			
	Daviesia ulicifolia	Gorse bitter pea	X				
	Dillwynia sieberi	-	X				
	Dodonaea viscosa subsp. cuneata	Wedge-leaf Hop-bush	X				
	Indigofera australis	Australian Indigo	X				
	Melaleuca linearifolia						
	Melaleuca nodosa	Prickly-leaved Paperbark					X
	Melaleuca styphelioides	Prickly-leaved Tea Tree		X			
	Pultenaea microphylla	-	X				
Sedges, Rushes, Reeds & Grasses	*Atriplex semibaccata*	Creeping Saltbush					X
	Aristida ramosa	Purple Wiregrass	X				
	Aristida vagans	Threeawn Speargrass	X				
	Baumea articulata	Jointed Twig-rush				X	
	Bolboschoenus caldwellii	Salt Club-rush				X	X
	Bolboschoenus fluviatilis	Marsh Club-rush				X	X
	Bothriochloa decipiens	Redleg Grass	X				

Type	Scientific name	Common name	Zones 1 - 6		Zone 7	Zone 8	Saline Areas
			CPW	AW	FW/ AW	FW	
	Bothriochloa macra	Red Grass	X				
	Chloris divaricata	Slender Chloris	X				
	Chloris truncata	Windmill Grass	X				
	Chloris ventricosa	Plump windmill brass	X				
	Carex appressa	Tall Sedge		X	X	X	
	Carex inversa	-	X		X		
	Carex pumila	Strand Sedge			X		X
	Cymbopogon refractus	Barbed-wire Grass	X	X	X		
	Cyperus gracilis	Slender Flat-sedge	X		X		
	Dichelachne micrantha	Shorthair Plumegrass	X	X			
	Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass	X	X			
	Echinopogon ovatus	Forest Hedgehog Grass	X	X			
	Eleocharis sphacelata	Tall Spike Sedge			X	X	
	Entolasia marginata	Bordered panic		X			
	Eriochloa pseudoacrotricha	Early Spring Grass	X				
	Gahnia clarkei				X	X	
	Imperata cylindrica	Blady Grass			X		

Type	Scientific name	Common name	Zones 1 - 6		Zone 7	Zone 8	Saline Areas
			CPW	AW	FW/ AW	FW	
	Juncus usitatus	Common Rush	X		X	X	
	Lomandra filiformis	-	X	X			
	Lomandra longifolia	Spiny-head Mat-rush		X	X		
	Lomandra multiflora subsp. multiflora	-	X	X			
	Microlaena stipoides var. stipoides	Weeping Meadow Grass	X	X			
	Oplismenus aemulus	Australian Basket Grass		X			
	Poa labillardieri var. labillardieri	Tussock Grass	X		X		
	Rytidosperma caespitosum	Ringed Wallaby Grass	X				
	Rytidosperma racemosa var. racemosa	-	X				
	Themeda triandra	Kangaroo Grass	X	X			
Groundcover Species (~0-1.5m) & Vines/Scramblers	*Brunoniella australis*	Blue Trumpet	X				
	Centella asiatica	Indian Pennywort	X	X			
	Clematis glycinoides	Old Man's Beard	X	X			
	Commelina cyanea	Creeping Christian	X	X			
	Cotula coronopifolia	Water Buttons			X		X
	Desmodium varians	Slender Tick-trefoil	X				
	Dianella longifolia	Blueberry Lily	X		X		

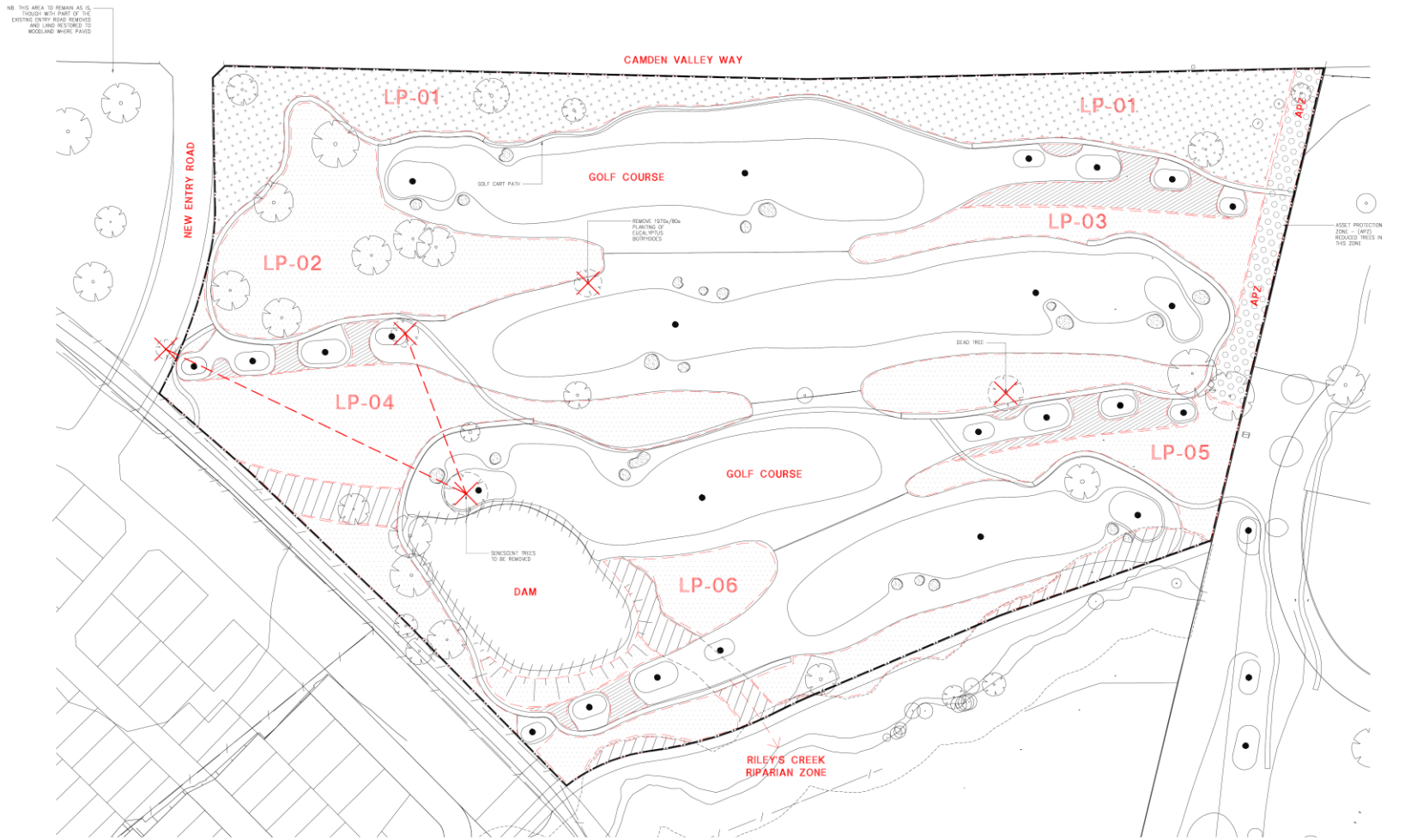
Type	Scientific name	Common name	Zones 1 - 6		Zone 7	Zone 8	Saline Areas
			CPW	AW	FW/ AW	FW	
	Dichondra repens	Kidney Weed	X	X	X		
	Geranium solanderi	Native Geranium	X	X			
	Glycine clandestina	Twining Glycine	X				
	Glycine microphylla	Small-leaf glycine	X				
	Goodenia hederacea subsp. *Hederacea*	Ivy Goodenia	X				
	Hardenbergia violacea	Purple Coral Pea	X	X			
	Phyllanthus virgatus	-	X				
	Pratia purpurascens	Whiteroot	X	X			
	Portulaca oleracea	Pigweed					X
	Plectranthus parviflorus	Cockspur flower	X	X	X		
	Veronica plebeia	Creeping Speedwell	X	X			
	Wahlenbergia gracilis	Sprawling Bluebell	X	X			

GHHA Canopy species (Britton 2015)

Scientific name	Common name
Angophora subvelutina	Broad-leaved Apple
Brachychiton populneus	Kurrajong
Eucalyptus amplifolia	Cabbage Gum
Eucalyptus baueriana	Blue Box
Eucalyptus crebra	Narrow-leaved ironbark
Eucalyptus eugenioides	Thin-leaved Stringybark
Eucalyptus moluccana	Grey Box
Eucalyptus paniculata	Grey Ironbark
Eucalyptus tereticornis	Forest Red Gum
Melaleuca styphelioides	Prickly-leaved Tea Tree (Riparian only)

Appendix D Landscape Plan

LP– 00 (Britton 2015)



LANDSCAPE DOCUMENTATION FOR GOLF COURSE

DRAWING LIST

- LP-00 - LANDSCAPE SITE PLAN
- LP-01a - MODULES
- LP-01b - LANDSCAPE SITE PLAN
- LP-02 - LANDSCAPE SITE PLAN
- LP-03 - LANDSCAPE SITE PLAN
- LP-04 - LANDSCAPE SITE PLAN
- LP-05 - LANDSCAPE SITE PLAN
- LP-06 - LANDSCAPE SITE PLAN

LEGEND:

- RIPARIAN ZONES
- CUMBERLAND PLAIN WOODLAND ONLY TREES AND GROUNDCOVER COMPONENTS
- CUMBERLAND PLAIN WOODLAND GRASSES ONLY (NO TREES)
- CUMBERLAND PLAIN WOODLAND REHABILITATION ALL STRUCTURAL COMPONENTS PRESENT TO FORM DENSE SCREEN
- SITE BOUNDARY
- REMOVE TREE
- EXISTING WOODLAND TREES TO BE RETAINED

NOTE: ALL EXISTING WOODLAND TREES RETAINED ARE TO HAVE WEEDS REMOVED WITHIN THE TREE DRIPLINE (RETAIN NATIVE GRASSES AND FORBS) AND MULCH UNDER DRIPLINE USING CHIPPED WOODLAND MATERIAL

1 — REFERENCE PLAN 1:1000

Calculated dimensions must take precedence over scaling. Check all position of services on site prior to commencement of works.

Issue for Issue
REV

1:500
0 20 50m 100m

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Client: S.H. CAMDEN LAKESIDE P/L
Project: GLEDSWOOD LOT 1201 DEVELOPMENT
Drawing title: LANDSCAPE SITE PLAN

Design consultant:
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ENVIRONMENTAL DESIGN & HERITAGE CONSULTANT
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Drawn: AM
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