



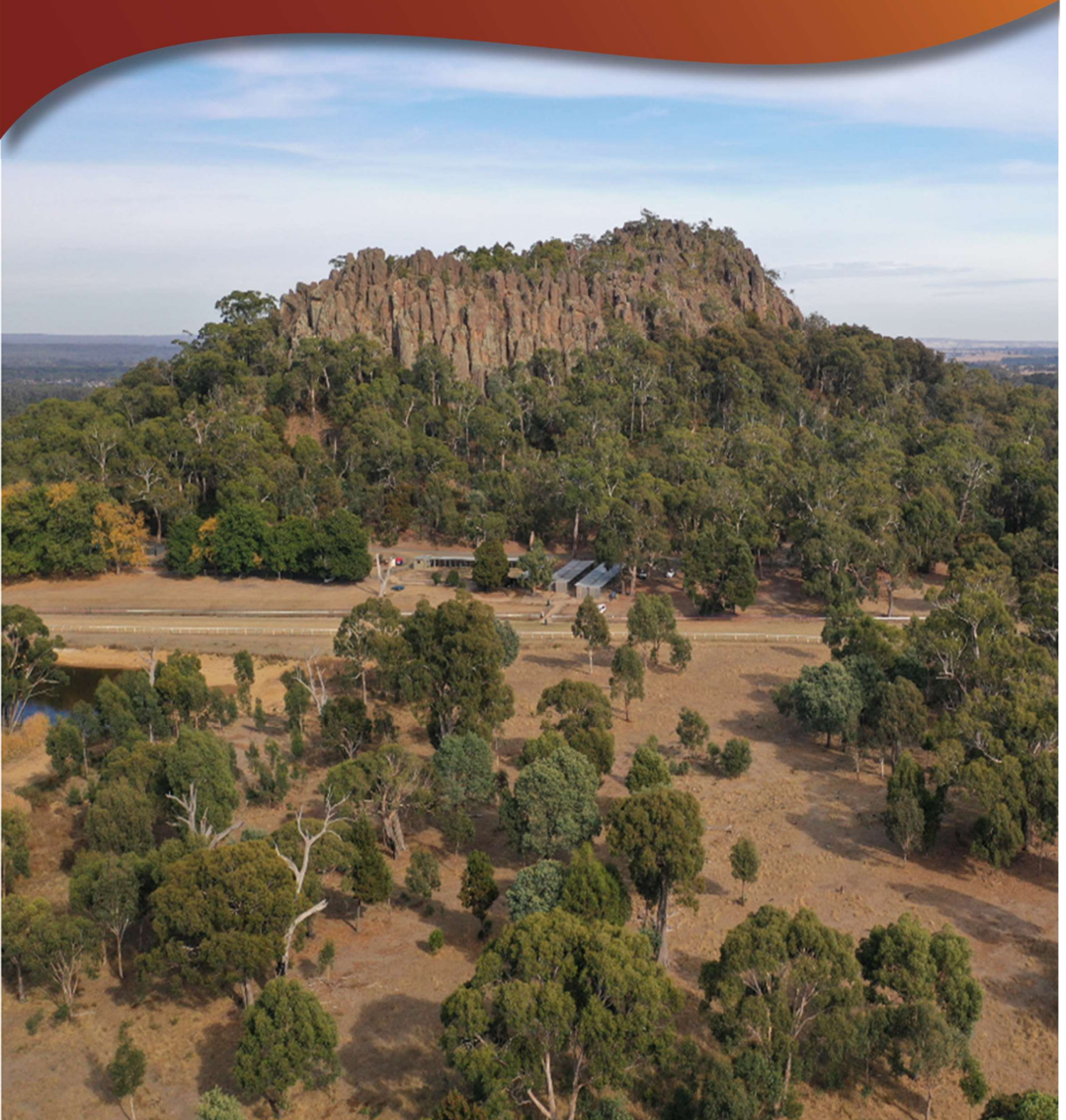
**Macedon
Ranges**
Shire Council

*Hangin
g
Rock*



Hangin g Rock Racecourse Grassland Management Plan

Adopted by Council 26 February 2020



Acknowledgements

The author would like to acknowledge the, Dja Dja Wurrung, Taungurung and Wurundjeri people of the Kulin nation and their Elders past, present and future as the custodians of the lands upon which we are located and where we conduct our business. The author acknowledges and respects their continuing culture and the contribution they make to the life of this city and its regions.

The author would further like to gratefully acknowledge Daniel Young of Macedon Ranges Shire Council for assisting in the preparation of this report and key stakeholders including Anne Walsh, Michelle Wyatt, Rod Clough, Martin Roberts, Beau Kent and Karen Muscat from the Macedon Ranges Shire Council, Catherine La Puma from the Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation and everyone who provided input, solutions and inspiration during the consultation period for the final Grassland Management Plan.

Cover photo: The Hanging Rock formation as viewed from above the Hanging Rock Racecourse (Drone photography - Abzeco 17/4/2019).

Authors: Geordie Scott-Walker & Adrian Lamandé

Report prepared for Macedon Ranges Shire Council By:



Adopted at Ordinary Council Meeting in its final form by Macedon Ranges Shire Council on the 26th February 2020.

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Executive Summary

Abzeco was commissioned by Macedon Shire Council in March 2019 to prepare a Management Plan to guide on-ground works at the Hanging Rock Racecourse Grassland (the grassland) in Newham, Victoria. The grassland encompasses approximately 8 hectares of Crown land located on the eastern portion of the Hanging Rock Reserve, approximately 100 kilometres north of Melbourne. Vegetation representative of a single Ecological Vegetation Class was identified as either grassland, grassy woodland or areas of semi-aquatic or mud mat vegetation around the dam. The developed methodology is based upon the identification and management of threats and opportunities including high threat weeds, revegetation of indigenous species and the active use of kangaroo management and planned burning, to maintain the site's values and is intended to guide Council's biodiversity management at the grassland into the future.

1 Introduction

Abzeco was commissioned by Macedon Shire Council in March 2019 to prepare a Management Plan to guide on-ground works at the Hanging Rock Racecourse Grassland (the grassland) in Newham, Victoria. The plan is intended to guide Council's biodiversity management at the grassland for the next five years and is based upon systematic elimination of high threat weeds, revegetation of indigenous species and the active use of kangaroo management and planned burning, to maintain the site's values.

This plan provides a review of historic land management of the grassland and provides guidelines for future works. Management mechanisms are aimed at mitigating the identified threats to the grassland environmental values while exploring opportunities to both enhance the reserves existing values, as well as introduce additional values to the grassland. These recommendations are in accordance with Abzeco's considerable knowledge and experience gained through the planning and implementation of environmental management within grassy ecosystems and threatened flora populations throughout southern Victoria.

This plan provides broad guidelines to ensure that management goals are achieved within the 5 year management period, which should in turn provide positive ecological outcomes for the grassland. The plan illustrates vegetation management guidelines and principles that are transferrable to future management plans and other local reserves under the management of Macedon Ranges Shire Council. A monitoring program has also been specified to support on ground management works and to detect unanticipated environmental events and site wide changes occurring as a result of management interventions. Monitoring will allow management to incorporate contingencies for any detected changes, remaining adaptive and able to be altered when necessary. All recommendations and requirements contained herein have been prepared in accordance with Council's project specifications and relevant legislative and statutory requirements.

Strategic directions and management objectives

The Hanging Rock Reserve is currently managed in accordance with the Environmental Management Plan (EMP, Smedley 2015a, 2015b) and the Hanging Rock Strategic Plan (Ethos Urban 2018). The two strategic plans provided background to the current management plan and detail the historical, environmental and social significance of the Hanging Rock environs.

The current EMP (Smedley 2015a, 2015b) provides broad guidelines for management of environmental values at the reserve and places priority on conservation values over recreational values within the designated conservation areas, which includes the Racecourse Grassland considered to be of national significance by Loder and Bayly (1993) due to the relative scarcity of grasslands throughout the bioregion. This management plan recognises and is broadly consistent with the existing approaches to reserve management outlined in the EMP (Smedley 2015a, 2015b), however explanations are provided in-text where deviations to these approaches are recommended. A current revegetation plan for Hanging Rock Reserve (Young 2018) does not provide specifications for the Racecourse Grassland but was reviewed during the preparation of this management plan.

The Hanging Rock Strategic Plan (Ethos Urban 2018) sets out strategic level objectives for the Hanging Rock Reserve based on a range of considerations including governance and management, environment, culture and heritage, tourism and recreation. Extensive background is provided on the environmental, social and cultural setting of the reserve however limited detail applies to the Racecourse Grassland.

2 Site background and management history

This section provides an overview of the layout and general composition of the reserve as well as information on the surrounding environs, the broad biophysical character of the site, its conservation values and its administrative setting.

2.1 Geographic and administrative context

The grasslands encompasses approximately 8 hectares of Crown land located on the eastern portion of the Hanging Rock Reserve, approximately 100 kilometres north of Melbourne. Box 1 and 2 outline the relevant title particulars, planning instruments and administrative jurisdictions of Hanging Rock Reserve as relevant to the Racecourse Grassland area.

Box 1. Title particulars of Hanging Rock Reserve.

Address: Unit 1/139 South Rock Road, Woodend 3442

Council Property Number: 1168841

Parish: Newham

Local Government Area: Macedon Ranges

Tenure: Public Land

Committee of Management: Macedon Ranges Shire Council

Directory Reference: VicRoads 60 B7

Box 2. Planning instruments and administrative jurisdictions for Hanging Rock Reserve.

Planning Zone: Public Conservation and Resource Zone (PCRZ)

Planning Overlays:

- Bushfire Management Overlay (BMO)
- Environmental Significance Overlay – Schedule 4 (ESO4)
- Heritage Overlay (HO88)
- Significant Landscape Overlay – Schedule 1 (SLO1)
- Hanging Rock is listed on the Victorian Heritage Register – VHR Number H2339

Fire and water authorities:

- 'Central' Country Fire Authority (CFA) Total Fire Ban district
- North West Region of the CFA
- North Central Catchment Management Authority (CMA)
- Modelled¹ as part of the Five Mile Creek catchment of the Campaspe River Basin that drains into the Murray River approximately 135km due north. Note that the Deep Creek/Maribyrnong River catchment occurs approximately 1km north-west of the reserve, which forms the north-western upper reaches of the Yarra River basin that drains south into Port Phillip Bay.

Government and electoral jurisdictions:

- 'Loddon Mallee' administrative region of the Department of Land, Environment, Water and Planning (DELWP)
- Macedon State Assembly of the Northern Victoria 2013 State Council Region
- Macedon Ranges East Assembly 2016 Ward

¹ Spatial layers SDL Catchments and SDL Basin © State Government of Victoria 2018, available online at Mapshare: <https://www2.delwp.vic.gov.au/maps/maps-and-services/interactive-maps>

2.2 Local biophysical landscape

The local landscape is characterised by a mixture of agricultural land and tourism uses within a rural setting characterised by open plains, rolling hills and broadacre grazing, cropping and smaller rural holdings supporting hobby farms and horse agistment. Higher density residences are restricted to the local townships of Newham and Woodend located approximately 2km north and 5.5km south-west of the study area, respectively. Major waterways of this area include Smokers Creek, Five Mile Creek, Deep Creek, Falls Creek and Garden Hut Creek.

Prior to colonial settlement and broadacre conversion to agricultural and forestry land uses, the local landscape was characterised by vegetation associated with foothill and plains landforms, including a variety of mixed eucalypt forests, sub-alpine woodland, swampy woodland, shrubland on exposed rocky outcrops and escarpments, shrubland on swampy flats, heathy woodland, a complex array of riparian woodland and forest types on low gradient drainage lines, freshwater wetlands, open grassy woodlands and in some areas, sparsely timbered areas of 'grassland'.

The vegetation of Macedon Ranges varies widely due to the combined effects of climate, topography, soils, hydrology and disturbance that include dry, sclerophyllous vegetation characterised by heathy and relatively drought-tolerant plants to the mesic flora of sheltered sites that support species less tolerant of exposure to wind and high temperatures. The current remnant vegetation is fragmented, mostly confined to hills and mountains that are unsuited to agriculture, as well as marginal lands where land use change has been relatively limited, such as local roadsides and cemeteries (e.g. at Kyneton and Carlsruhe).

Diogenes land system, local geology, soils and climate

The racecourse reserve is located within the Central Victorian Upland bioregion (CVU) that is a sub-set of the Midlands Victorian IBRA region². Three local eruption points including Hanging Rock, The Jim Jim and The Camels Hump are prominent volcanic domes, with Hanging Rock and The Camels Hump known in geological terms as small but steep-sided mamelons³ of acidic trachyte basalt. The local area including and surrounding Hanging Rock Reserve falls within an area of approximately 41km² known as the Diogenes⁴ land system⁵ that is formed of volcanic plains originating around 6-7 million years ago during the Tertiary period, consisting of a complex mixture of basaltic parent material overlying sandstone and mudstone (Singleton and Lorimer 1992, Lorimer and Schoknecht 1987). The Diogenes land system has developed into a gently undulating plain with isolated cones (see Figure 1).

The topography of the Hanging Rock Reserve grades from a volcanic crest at 711m above sea level, (Mount Diogenes/Hanging Rock) descending over a short distance from steep to moderate and then outwash slopes, which eventually forms a gentle to very gentle slope at 600-610m altitude approximately 500m from the crest to the plain. Drainage depressions provide relatively low-relief and within the Racecourse portion of the reserve terminate at a large dam, which further retards the naturally slow drainage profile of the gentle slopes. Natural watercourses of broad, low

² Interim Bioregographic Regionalisation for Australia Version 7.0, available online: <https://www.environment.gov.au/land/nrs/science/ibra>

³ A mamelon is a type of lava dome that develops by internal accretions and swelling of lava without the presence of viscous lava; the extrusion can become a visible feature of the surface geology through the gradual weathering of surrounding relatively erosive materials.

⁴ Hanging Rock is also known as Mount Diogenes

⁵ The Diogenes land system forms about 1% of the Campaspe River Catchment area (Lorimer and Schoknecht 1987)

gradient plains in this landscape have low permeability and a high risk of flooding (Singleton and Lorimer 1992), however the surrounding slopes are somewhat poorly drained to well drained and have moderate surface permeability and slow subsoil permeability (Lorimer and Schoknecht 1987).

The plains adjacent to local watercourses of the Hanging Rock Reserve support deep, well-structured uniform clay soils, whereas Hanging Rock itself supports shallow silty loams with basalt surface rock prominent. The areas intermediate between the gentle plains and rocky crest and upper slopes generally support sandier textured soils resulting from outwash (colluvium) that leads to the development of well drained silty loams, and in some cases these gradational soils support ironstone (buckshot) in the lower parts of the upper (A) soil horizons (Lorimer and Schoknecht 1987).

The Macedon Ranges climate is temperate, consisting of hot, dry summers and cold, wet winters. Annual rainfall of 800-900mm is lowest in January and highest in August (Lorimer and Schoknecht 1987), with the average number of rain days in Woodend ranging from 7 per month in January and February to 18 per month in July and August (Singleton and Lorimer 1992). Historic temperatures recorded at the Macedon Nursery (503m altitude) are observed to be highest during January/February (average maximum 24.3-25.1°C) and the lowest in July (average minimum 2.1°C). The average incidence of frost⁶ around Kyneton is most prevalent from May through September, peaking in June (average of 20 frost events including 20 years of sampling data, Singleton and Lorimer 1992). The seasonal growth limitation include temperatures less than 10°C average, spanning April to September, and rainfall less than potential evapotranspiration from October to March (Lorimer and Schoknecht 1987).

Local soils in combination with local climate and a variety of other drivers have led to the development of woodlands and forest on the Diogenes terrain. Characteristic canopy species include Manna Gum *Eucalyptus viminalis* and Snow Gum *Eucalypt pauciflora* subsp. *pauciflora* on rocky crags and the upper slopes of Hanging Rock, grading downslope to include Messmate *Eucalyptus obliqua*, Candlebark *Eucalyptus rubida* and Narrow-leaf Peppermint *Eucalyptus radiata* on moderate slopes, and Manna Gum, Snow Gum and Swamp Gum *Eucalyptus ovata* on gentle slopes with the addition of understorey trees Silver Wattle *Acacia dealbata* and Blackwood *Acacia melanoxylon* (Singleton and Lorimer 1992). Manna Gum and Swamp Gum are also dominant on lower lying land prone to inundation and waterlogging.

2.1 Property description of the Racecourse Grassland and immediate surrounds

The Racecourse Grassland itself is bound by the Hanging Rock Racecourse, which lies on levelled land that cuts through a rise on the northern portion of the site. The interior of the racecourse, defined by a racing barrier is characterised by a gentle gradient declining north-south that encompasses two relatively high points in the north and east where emergent basalt surface rock is present, a large dam features in the southern portion which collects runoff along a relatively small catchment from adjacent land north and east of the reserve. The dam features an area of raised earth that functions as an island when water levels are high, and an additional elevated mound lies on the northern edge. The remainder of the land is relatively low lying, forming a gentle gradient with surrounding elevated areas.

⁶ Frost events are recognised for all temperate records <2.2°C

A disturbed area characterises the eastern edge of the dam where an old gravel track, tables and chairs and a short dam jetty occur. A swale drain also runs east-west downslope of these features. Two other artificial drains occupy the land, including a culvert in the north-east of the reserve that presumably carries flows under Colwells Road to the north and roughly follows natural southern drainage flows, as well as a short swale in the west near racecourse infrastructure associated with an area of raised earth suitable for vehicle access. Both drainage lines direct flows south to the dam. Downslope of the dam lies an open sports oval, and to the west are horse racing facilities including stables, the primary horserace tower, outbuildings and public viewing and sitting areas. The amenities west of the racecourse lie on the elevated shoulder of the slope abutting Hanging Rock, making Hanging Rock a prominent backdrop to the western view from the grassland, and Mount Macedon with Camels Hump prominent to the south. The eastern and northern verges of the grassland are forested with native eucalypts and basic property infrastructure including cyclone fences, a secondary race viewing tower and land east of the reserve that has been set aside to improve the conservation values of the reserve. The land gradient of the reserve ranges from 610m ASL on the elevated, northern rocky rise, and 600m at the sports oval south of the reserve area.

2.2 Management planning and background literature

This section provides a brief summary of historic management plans and reports pertinent to the current and future management of the Hanging Rock Racecourse Grassland (referred to as Racecourse Grassland herein). The most recent environmental management plan for Hanging Rock Reserve (Smedley 2015a, 2015b) provides the background to this report.

2.2.1 Early recognition of grassland values and conservation management

Loder and Bayly (1993) recognised the Racecourse Grassland as floristically the most important plant community in the reserve, owing to the relative scarcity of grasslands within the region. The grassland was noted to be in good condition and one of the least disturbed areas of the Hanging Rock Reserve at the time of assessment. Mosaic burning was recommended at five year frequency throughout grassland areas to reduce biomass, increase inter-tussock spaces and encourage regeneration (Loder and Bayly 1993). Fire was further recognised as a regular feature of grassland management by a previous Shire Ranger, taking the form of strip burning on 2-3 year rotations, for an unknown period until its cessation (DSE 2007).

2.2.2 Vegetation disturbance due to dam maintenance – 2007

During historic dam maintenance works in 2007 a contractor stockpiled dredge materials north of the dam, inadvertently causing impact to native vegetation (see Section 5 - Zone 4A). As a result of the incident a set of guidelines for grassland rehabilitation and management were prepared by the (then) Victorian, Department of Sustainable Environment North West Region (DSE 2007), which identified threats and opportunities including the following key actions:

- develop a grassland flora list;
- manage eucalypt recruitment;
- reinstate the historic strip burning regime but on a 3 year rotation;
- permanent removal of cattle;
- develop clear contractor management procedures;
- prevent inappropriate disturbances such as cultivation and vehicle disturbance;

- improve grassland condition through weed control and revegetation, including planting nursery grown plants and direct seed using native grass;
- strategically use burning, or in some cases slashing/mowing to improve grassland condition;
- improve water condition through riparian plantings; and,
- provide appropriate monitoring to inform management.

2.2.3 Hanging Rock Racecourse ‘grassland’ assessment – 2013

A preliminary assessment of the ‘grassland’ area of the reserve – broadly encompassing the northern half of the central part of the reserve – was completed in 2013 (Foreman 2013). The assessment identified that the original watercourse feeding into the constructed dam is channelized. The assessment also pointed out that the Newham Parish Plan 1867 indicated the presence of a ‘spring’ to the west of the dam possibly a natural occurrence of a spring-soak supporting groundwater dependent vegetation. Foreman identified the presence of a River Red Gum in the vicinity of this location, a possible remnant of the original spring-soak, however this tree was not observed during the current survey. Foreman postulates that the landscape may have once supported an open grassy structure, in treeless areas forming a disclimax grassland, based on parish plans and the likelihood that historic aboriginal people used fire to manage the vegetation. In reflection of the high botanical and habitat values identified during the assessment, it was recommended that a detailed flora survey and condition mapping, and preparation of a conservation management plan should be developed for the Racecourse Grassland.

2.2.4 Grazing exclusion research – 2016 to 2018

The EMP Background Report (Smedley 2015a) set out monitoring requirements including the establishment of Racecourse Grassland grazing exclusion plots to measure the effects of Eastern Grey Kangaroo *Macropus giganteus* grazing and grazing exclusion on the cover and diversity of indigenous species. Three plots were established in 2016 with annual spring assessments until 2018 to document condition change (Just 2018). The results of this research (Just 2018) highlight that kangaroo grazing is having a large impact on indigenous vegetation structure and provides substantial evidence for the need to actively manage grazing within the Racecourse Grassland (Just 2018).

The research plots compare grazed and un-grazed vegetation condition at three discrete locations (see Figure 3 for locations). Each plot had a 2.5m² rabbit-proof fence erected with an adjacent unfenced plot of the same size close by. Kangaroo exclusion was achieved by the fence and small plot size of the plot restricting animal access. Detailed results over three years demonstrates a consistent pattern in vegetation development across each plot, with a rapid increase in surface biomass in grazing exclusion plots over the duration of the study. Each plot was shown to support a diversity of both indigenous and exotic flora species that are otherwise suppressed or seemingly absent within the grazed (control) plots, including numerous characteristic ground flora of terrestrial grassy ecosystems such as orchids, grasses, daisies, peas, lilies, sedges.

A general trend of increased vegetation cover was demonstrated across all plots, including a general increase in cover of all major plant groups (including indigenous and exotic grasses and forbs). However, indigenous forbs were shown to have their most cover in the first year following grazing exclusion (approximately 21% cover compared to 16% in control plots), declining over time as native grass became the dominant structural feature (see Just 2018). Although native forbs had highest cover levels within the grazing exclusion plots in the first two years, their cover was

only slightly lower in un-grazed plots, indicating that seasonal effects such as rainfall, rather than grazing alone, affect the abundance of indigenous forbs.

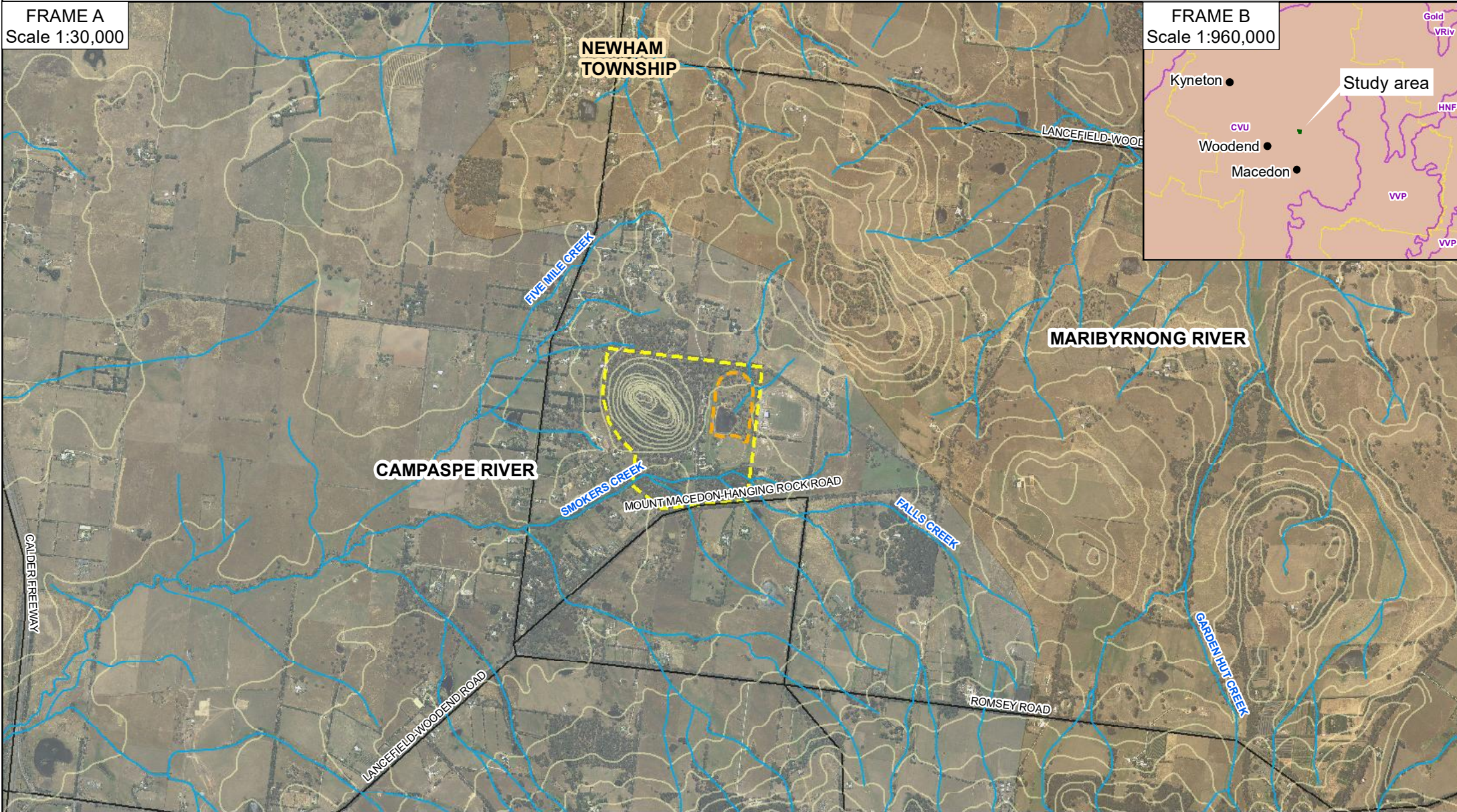
Exotic grasses and forbs increase progressively within the grazing exclusion plots over the first two years of the study but decline in year three as native grass attains its greatest cover (~80% cover). Conversely, indigenous grasses underwent an overall trend of decline across the three years in control plots, possibly in response to changing grazing pressure but also possibly due to seasonal conditions, and within these same plots exotic forbs had high cover of ~45% and ~40% in 2017 and 2018, respectively.

Just (2018) highlighted the significant changes observed in this study for the dominant native grass, Kangaroo Grass *Themeda triandra*, which increased substantially through grazing exclusion and appeared to decline in control plots. At the same time the decline in indigenous forb cover within grazing exclusion plots highlights the importance of biomass management to temper grass dominance, although dry conditions sustained during 2017-18 were also considered pertinent to forb abundance (Just 2018). Exotic grass cover did not appear to change greatly between control and grazing exclusion plots during this study, and it has been suggested that the abundance of dominant exotic grasses in such plots is likely to change each year in response to rainfall rather than disturbance (Zeeman 2017) (e.g. species supporting an annual or biennial life history such as Sweet Vernal-grass *Anthoxanthum odoratum*).

2.2.5 Dam condition assessment - 2019

An assessment of the racecourse dam identifies management issues in relation to public safety and dam function, primarily from an engineering perspective (SMEC 2019). Minor erosion on the upstream face of the dam necessitates the removal of Cumbungi from nearby areas and installation of rip rap to protect these areas. This species is often an indicator of high nutrients and its removal can lead to raised nutrient levels. Irregular harvesting is preferential to complete removal of Cumbungi, as the species sequesters nutrients, pollutants and carbon and removal can cause a release of these. Any works undertaken as part of dam maintenance must take care, in accordance with the principles and guidelines of this management plan to protect the reserves biodiversity values, especially if machinery, vehicles and heavy equipment are necessary to complete the repairs.

Figure 1. Locality and landscape context of Hanging Rock Racecourse Grassland, Newham.



- Study area
- Hanging Rock Reserve
- Watercourse
- Contour - 10m
- Major roads

- Campaspe River basin
- Maribyrnong River basin
- Local Government Area (Frame B)
- Bioregion boundary (Frame B)

Location of property boundaries, watercourse & topography indicative only

Scale to GDA 1994
print A4 MGA Zone 55

0.5 0.25 0 0.5 1
Kilometers

Map created 23 April 2019

Created by Geordie Scott-Walker

Report: 19021 - map version 1.0

File: J:\Jobs\2019\19021-MacedonRangesShire Council-HangingRock RacecourseGrassland

Abzeco Pty. Ltd
Suite 1, 4 Brisbane Street
Eltham, Victoria 3095
Ph 03 9431 5444
www.abzeco.com.au



3 Racecourse Grassland values and land management issues

The Racecourse Grassland supports significant biodiversity values including rare plants, animals, native vegetation communities and habitat for wildlife. As part of ensuring the conservation, maintenance and enhancement of the reserve's biodiversity values, Council needs to address a range of issues such as high threat weed invasion and biomass control.

3.1 Site assessment

The study site was inspected on 29 March 2019 to inform the preparation of this plan. The purpose of site inspection(s) is to describe the current site condition and document the site's values as well as identify significant land management issues. Relevant features of the study site were recorded as a geographical point on an electronic map using the GIS software application ESRI ArcPad™, a tablet (Panasonic, Toughpad FZ-G1) and Bluetooth GPS (Holux RCV-3000; accuracy up to ~3 m).

Reporting conventions for species nomenclature and taxonomy

Scientific and common names of plants follow the determinations of Walsh and Stajsic (2007), DEPI (2014), the Flora of Victoria Online (2019) and the Victorian Biodiversity Atlas (VBA) (DELWP 2019). Names of plants are generally introduced in-text by use of the common name followed by the scientific name, and subsequently only refer to the common name. For fauna species, names are adopted from DSE (2009, 2013) and the VBA.

Where an asterisk symbol (*) appears in-text as a prefix to a flora or fauna scientific name this indicates the entity to be exotic to Victoria or Australia. A hash symbol (#) prior to a plant scientific name denotes those species native to Australia or Victoria but non-indigenous to the study area or to the relevant vegetation type.

Field survey limitations

Flora and fauna observations and site condition documented during any field surveys are dependent on the time of year, recent climatic conditions and the management history in the lead-up to the surveys. Field surveys are also constrained by the time allowance and will depend substantially on the expertise of the surveyor to identify all possible site values and management issues in a given area.

Field surveys commonly do not record all species present in a study area. As an adaptation to unfavourable environmental conditions such as excessive heat or drought, some grassland flora species spend part of their life-cycle as underground storage organs or seed. These species will re-sprout or germinate when favourable conditions return, such as after rainfall. In Victoria these species will tend to re-emerge during winter and are most visible during spring, which is the flowering period for a majority of plant species. Conducting surveys in the main flowering season enhances the detectability of plants and the ability of assessors to confirm species identify.

Field surveys also often fail to identify all of the management issues that exist at a site, especially those that are spatially or temporally transient. Land management issues may not be apparent if they are intermittent or difficult to detect, such as occasional rubbish dumping or tunnel erosion.

The outcomes of the survey completed at the reserve were achieved by two ecologists within a total of 8 hours during early autumn immediately after a dry summer. Although brief, this assessment period is considered sufficient to inform the report. It is expected however, that

management issues and site values will change over time and these changes should be incorporated into future management plans and any reports on the work completed as part of this plan.

Historic flora and fauna surveys of the reserve include numerous species that were not recorded during the site assessment completed for this report. The grazing exclusion plots of Just (2018) highlight a suite of flora species that can be overlooked due to grazing effects, and the companion control plots demonstrate how the current flora survey results may be affected by dry autumn conditions. A large suite of species were clearly overlooked during the current survey, primarily due to the effects of seasonality and grazing, most notably small annual graminoids and perennial spring flowering herbs, including native and exotic daisies, lilies, orchids, grasses and many other species.

3.2 Site Values

The Racecourse Grassland was accessed on 29 March and 17 April 2019 and a record was taken of all vascular flora and fauna observed. The results of the assessment are summarised in the sections below and in Appendices 1 and 2.

3.3 Flora values

One hundred and seven (107) flora taxa were recorded within the Racecourse Grassland search area, including 68 indigenous and 39 exotic species.

Several stands of Sedge *Carex* spp. were observed growing along the channelised drainage line and on the upper banks of the dam's northern verge, which could not be identified to species level due to a lack reproductive material. These taxa were suspected to be River Sedge *Carex polyantha*, recorded by Foreman (2013) but confirmation is required and should be completed at a more suitable time. The current flora survey results clearly understate the floristic richness of the reserve, due to a combination of survey timing, local climate and grazing effects. Historic flora surveys (Foreman 2013, Just 2018) demonstrate a high diversity of herbaceous flora including daisies, lilies, orchids, grasses and other taxa that were not observed during this assessment. A more complete account of the reserves floristic richness could be achieved from a spring survey following good winter rains, ideally in the absence of heavy grazing pressure. Additionally, changes brought about by land management should be constantly monitored as it is expected that management will provide differing opportunities to different species. When this is combined with the cryptic nature and specific requirements for emergence of some species it is likely that regular flora surveys will provide on-going detection of new flora species and should be completed at regular intervals. Previous survey reports should be viewed to highlight the likely flora species that may be encountered at the reserve.

3.3.1 Significant flora species

Two species of conservation significance (Pale Swamp Everlasting *Coronidium gunnianum* and Floodplain Fireweed *Senecio campylocarpus*) were identified during the flora surveys. Both species are considered rare in Victoria (DEPI 2014). One further species considered to be of regional significance was recorded during flora surveys (Lowland Snow Gum *Eucalyptus pauciflora* subsp. *pauciflora*). Another species of regional significance (Leafy Fireweed *Senecio squarrosus*) was previously reported by Foreman (2013) and is considered likely to still be present within the reserve. While it was not noted during the field assessment, Dwarf Silver Wattle *Acacia*

nanodealbata was identified in the north west of the study site by Kelsey Tucker and its identification confirmed by Neville Walsh via email on the 12th February 2019.

The location of rare or threatened flora species are depicted in Figure 3.

3.4 Fauna values

The VBA includes records for 101 fauna species, including nine (9) introduced species and four (4) species listed as Vulnerable on the *Advisory list of threatened vertebrate fauna in Victoria* (DSE 2013). The large number of recent records demonstrates that both the greater Hanging Rock Reserve and the Racecourse Grassland play a significant role in habitat provision for a wide range of fauna species.

3.4.1 Significant fauna species

Iconic fauna including Koala *Phascolarctos cinereus* currently use the Racecourse Grassland as habitat and were observed active in trees within the study site at the time of assessment. Brush-tailed Phascogale *Phascogale tapoatafa*, Powerful Owl *Ninox strenua* and Grey Goshawk *Accipiter novaehollandiae* all listed as 'Vulnerable' on the *Advisory list of threatened vertebrate fauna in Victoria* (DSE 2013) are likely to use the reserve as habitat or for foraging or feeding and are well represented in the local area according to a VBA database search (DELWP 2019). Despite being recorded within the VBA of occurring within 1km of the Racecourse Grassland, given the lack of connectivity between the dam and other sources of permanent water the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Murray Cod *Maccullochella peelii* is considered unlikely to occur within the reserve.

3.5 Vegetation types

The Racecourse Grassland supports three major vegetation types, all of which exist in a derived state and are present due to historic vegetation management within the area of the racecourse. Vegetation representative of a single Ecological Vegetation Class exists within the Racecourse Grassland as either, derived grassland, derived grassy woodland or areas of derived semi-aquatic or mud mat vegetation around the dam. The derived nature of this flora makes it no less significant in composition and function. Preservation of the existing states is preferable for the preservation of line of sight for the racecourse as well as for historic, cultural, social and environmental reasons.

Given the derived structure of the vegetation within the Racecourse Grassland, management needs to consider the role it plays in reinforcing the existing vegetation states. Significant flora such as Floodplain Fireweed *Senecio campylocarpus*, as well as areas of mud mat vegetation have been supported and flourished within areas of terraforming due to seasonal inundation and regular drying brought about by the rising and falling of dam levels.

3.5.1 Ecological Vegetation Classes

Ecological Vegetation Classes are a 'topology of vegetation' unit used in Victoria to enable consistent state-wide monitoring of vegetation. The scheme describes vegetation in terms of structural features, fidelity to particular land and soil types and key ecological processes that drive system function, providing a derived benchmark condition for vegetation in a relatively undisturbed state.

The Racecourse Grassland is characterised by vegetation that is most representative of the Victorian Ecological Vegetation Class (EVC) *Valley Grassy Forest* (EVC 47). Historic canopy tree clearance and preservation of 'line of sight' for turf racing has resulted in a derived grassland or grassy woodland state throughout the area of Hanging Rock Racecourse Grassland. Nevertheless, the geomorphology and the floristic composition and structure within the remaining vegetation, demonstrates close alliances to that which would be expected to occur within vegetation representative of *Valley Grassy Forest* (EVC 47).

Areas of vegetation representative of *Swampy Riparian Woodland* (EVC 83), *Herb Rich Foothills Forest* (EVC 23) and *Plains Grassy Woodland* (EVC 55) occur close to the Racecourse Grassland and within the bounds of the greater Hanging Rock Reserve. The Hanging Rock Racecourse Grassland sits close to the modelled boundaries of these EVC's and characteristics of each can to a greater or lesser degree be observed within the Racecourse Grassland. This observation suggests that while the vegetation is more representative of *Valley Grassy Forest* (EVC 47) with a cleared canopy, it was likely once within an area where vegetation gradually graded between two or more of the surrounding EVC's.

While areas of ephemeral stream within the Racecourse Grassland are most probably also an ecotone of vegetation representative of *Valley Grassy Forest* (EVC 47), the wetland and associated vegetation within the study site is derived and only present due to the damming processes that have been historically undertaken to ensure water availability for the entire reserve including the racetrack. Descriptions of the benchmark condition of terrestrial EVCs within the CVU are available online⁷.

3.5.2 Listed threatened vegetation communities

The *Valley Grassy Forest* Ecological Vegetation Class (EVC 47) is listed as Vulnerable within the CVU and VVP⁸. Under the Commonwealth EPBC Act criteria for Threatened Ecological Communities, the area of flora immediately around the dam may conform to the Critically Endangered *Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains* (DOEE 2019). This is due to the strong wetland characteristics, current species composition and generally treeless nature of the vegetation, as well as its connectivity to other areas of remnant vegetation.

3.5.3 Significance of the vegetation

Grassy ecosystems throughout south-east Australia have suffered significant decline since colonial settlement, exacerbated within the Greater Melbourne region by the rapid growth and expansion of urban areas. Reserves including the Racecourse Grassland, able to support grassland flora, cryptic fauna, habitat for common fauna and native vegetation of Commonwealth significance, are essential for local biodiversity conservation (Kendal 2007). Further to this, land clearance for agriculture in the local area has resulted in steep declines in the extent and connectivity of native vegetation. The Racecourse Grassland occurs close to the boundaries of two bioregions and contains a unique mix of montane, woodland and grassland flora and fauna assemblages. The Racecourse Grassland reserve is therefore considered a precious environmental asset to the community of the Macedon Ranges Local Government Area and the broader Central Victorian Uplands and Victorian Volcanic Plain bioregions.

⁷ <https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks>

⁸ https://www.environment.vic.gov.au/__data/assets/pdf_file/0012/50511/Bioregional-Conservation-Status-for-each-BioEVC.pdf



Image 1. Large mob of Kangaroos within the Racecourse Grassland



Image 2. Iconic species such Koala are present within the Racecourse Grassland

4 Land management threats and opportunities

A variety of land management issues affect the ongoing conservation values of the grassland and must be actively managed to conserve biodiversity values and ensure the grassland's sustainability. The key issues that currently require management include overgrazing and camping of kangaroos, biomass accumulation and pest plant and animal invasion.

4.1 Kangaroo Grazing

The grassland supports an existing perimeter fence that is disproportionately important to the protection of the site from kangaroo grazing. The monitoring of grazing exclusion plots set up within the reserve in spring 2016 has demonstrated that grazing by Eastern Grey Kangaroos *Macropus giganteus* is occurring preferentially on indigenous species. This preferential grazing on indigenous over exotic species is having a significant impact on vegetation structure (Just 2018) and could be driving compositional change of the vegetation in the longer term within the Racecourse Grassland. Further, the site assessment completed for this management plan identified that a large mob of kangaroos currently uses central areas of the Racecourse Grassland as their daytime resting spot due to the shade and shelter it provides. This is also having a significant impact on the vegetation of the area as these resting areas / dugouts are often compacted and bare predisposing them to weed invasion and altering the vegetation composition and structure. These management issues are common to conservation reserves with large kangaroo populations and they present a significant challenge to Council at this reserve because of the perceived social and cultural value of kangaroos. Despite this overgrazing by kangaroos is clearly causing damage to the grassland composition and structure and management of kangaroo needs to be considered if floristic diversity is to be maintained within the Racecourse Grassland.

Methods for kangaroo grazing management

A reduction of grazing pressure can be achieved via a number of different management actions including reducing kangaroo numbers by culling, implementing exclusion either partially or completely from the Racecourse Grassland or by fencing water points in the local area encouraging kangaroos to disperse throughout the landscape naturally.

Additional kangaroo grazing opportunities

It is recommended that a landscape scale Kangaroo Management Plan is prepared for the Hanging Rock Reserve to fully research the available options for management. This plan should identify a suitable carrying capacity for each of the individual areas within the Hanging Rock Reserve and consider kangaroo movement in the broader landscape.

A kangaroo management plan should inform the recommended reduction of kangaroo grazing pressure on the Racecourse Grassland. This is not to say that beneficial kangaroo grazing cannot be used as a management tool in order to provide some level of biomass control, however any biomass control achieved from kangaroo grazing should represent a more natural process where short pulse grazing by kangaroos is followed by longer resting periods when kangaroos disperse from the local landscape in search of water. Many of the recommendations within this plan assume the removal of kangaroo grazing pressure. If grazing is not reduced within the Racecourse Grassland either totally or partially, management will need to be adapted to this consideration.

4.2 Noxious weeds and declared pest animals

The site assessment identified seven (7) species of declared pest plants under the Victorian *Catchment and Land Protection Act 1996* (the CaLP Act), including Hawthorn **Crataegus monogyna*, English Broom **Cytisus scoparius*, Montpellier Broom **Genista monspessulana*, Sweet Briar **Rosa rubiginosa*, Common Blackberry **Rubus anglocandicans*, and Spear Thistle **Cirsium vulgare*. Broom and Gorse are also regarded as Weeds of National Significance⁹. Most other species of exotic flora present within the Racecourse Grassland are environmental weeds. Weed invasion into natural ecosystems is a well-recognised threatening process (e.g. TSSC 2010) that poses a significant threat to biodiversity. Of the 37 species of exotic flora identified during the field assessment, 24 were considered to have a high likelihood of elimination if appropriate management is completed. The remaining 13 exotic species were considered to have a low likelihood of elimination and control of these species should only be considered in specific circumstances.

Pest animals under the CaLP Act including European Rabbit **Oryctolagus cuniculus*, European Brown Hare **Lepus europaeus* and Red Fox **Vulpes vulpes* were identified as occurring within or immediately adjacent to the Racecourse Grassland. These species are identified as invasive (DOEE 2019) and a plan to control these species within the greater landscape should be prepared.

Declared pest plants and animals recorded at the reserve are included in the flora and fauna lists of Appendix 1 and 2. High threat weeds are defined in Appendix 3.

Methods for weed and pest management

High threat weeds will be managed for the duration of the five year management period, with a view to eliminating or reducing to <1% cover of all woody weeds. All high threat herbaceous weeds will be managed in accordance with the requirements of each zone and with consideration for key ecological processes including local climate, grazing and burning. Annual and low-threat weeds will only be controlled on an as-needs basis in response to site disturbance or as part of revegetation works to reduce the risk of further spread. New weeds must not be allowed to establish and spread, especially high threat graminoid species such as exotic stipoid grasses (e.g. Serrated Tussock and Needle Grasses **Nassella* spp.) and Toowoomba Canary-grass **Phalaris aquatica*.

All weed management must be carried out in a sensitive manner to avoid disturbance and negative impacts to native vegetation. Weed control should use a combination of manual techniques (e.g. hand weeding) and chemical-based approaches as part of an integrated approach. All herbicide use must only be performed by suitably qualified and experienced persons in accordance with the legal requirements for agricultural chemicals, and use where possible selective chemicals and low-volume application methods to reduce off-target risk.

All rabbit warrens within the reserve and within adjacent bushland areas to the north and east (within the Racecourse Reserve boundary) shall be fumigated and monitored for reinvasion.

Additional weed and pest management opportunities

It is recommended that either a landscape scale Pest Animal Management Plan is prepared for the Hanging Rock area or options under the Macedon Ranges Shire Councils current Pest Animal Management Plan are investigated to fully research the available options for management. The potential of Rabbit proof fencing the study site should be considered as well as how to best achieve

⁹ <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>

pest animal control in cooperation with neighbouring landowners as part of an ongoing co-operative control program.

The use of sugar could be adopted to reduce soil nitrate availability and generate a subsequent reduction of weeds while increasing natural regeneration in combination with or without revegetation. Smallbone, Prober and Lunt (2008) have demonstrated the value of sugar application in reducing winter-active broadleaf weed vigour in turn increasing native vegetation when combined with spring burning. The method broadly involves evenly dispersing a labile form of carbon at 0.5kg/m², e.g. using granulated sugar. The treatment is applied in autumn, winter and spring to temporarily alter soil microbial activity during the period of active nitrate release associated with wetter months of the year. If used inappropriately sugar can damage plant matter and must therefore be used cautiously.

Other studies are underway using novel alternatives to this method, such as mixing sawdust with labile carbon (sugar) during the initial treatment to reduce the need for secondary and tertiary treatments.

4.3 Revegetation and enhancement

The EMP (Smedley 2015a, 2015b) does not recommend revegetation in areas of Hanging Rock that currently support a cover of native vegetation greater than 25%. Despite this revegetation of the Racecourse Grassland could be considered in order to improve the sites floristic and habitat values and provide an increased level of competition to aid weed control attempts. Native vegetation condition and the degree of weediness vary throughout the site and in the absence of grazing out competing weeds becomes an important consideration in reducing the required management inputs. Natural regeneration post burn is likely to provide a suitable level of competition to reduce weediness and supplementary revegetation methods are unlikely to be required. However, if greater species diversity was desired or greater weed competition required a variety of supplementary revegetation methods could be considered to counter the relevant site constraints, including planting of nursery-grown materials and direct seeding.

Methods for revegetation and enhancement

The following methods can be read in conjunction with the existing revegetation plan for the Hanging Rock Reserve (Young 2018). Revegetation is best completed immediately following planned burns to capitalise on open conditions and extensive pre- and post-burn weed control. In a post-burn condition it will also be possible to identify any areas unsuitable for revegetation. The Racecourse Grassland will benefit from an increase in cover and diversity of native forbs and graminoids including robust mat-forming and showy species, such as Slender Speedwell *Veronica gracilis*, Matted Flax-lily *Dianella amoena*, Lemon Beauty-heads *Calocephalus citreus*, Common Everlasting *Chrysocephalum apiculatum* ssp. *apiculatum*, Golden Billy-buttons *Pycnosorus chrysanthes*, Pale Swamp Everlasting *Coronidium gunnianum* and Tufted Burr-daisy *Calotis scapigera*. These species should be complemented with peas (Fabaceae) and scrambling herbs including Purple Coral-pea *Hardenbergia violacea*, Running Postman *Kennedia prostrata*, Grey Parrot-pea *Dillwynia cinerascens*, Common Hovea *Hovea heterophylla*, Narrow-leaf Bitter-pea *Daviesia leptophylla* and Common Fringe Lily *Thrysanotus tuberosus*, in the more rocky areas of slightly higher ground. Over time these species will provide good competition against exotic species, improve the pedestrian site view and add to the visual aesthetic of the area.

Site lines must be maintained to ensure safe horse racing. An increase to shrub and tree cover will therefore decrease safety by interfering with sight lines and needs to be considered when selecting

appropriate species for revegetation. Occasional showy shrubs may be suitable if planted in a sparse distribution.

Given the observed indigenous grass species composition it is likely that with a reduction in grazing pressure an increased cover of indigenous grasses will occur, thus negating the need for broad scale revegetation of the grassy layer. It is possible however that following a reduction in grazing pressure, discrete patches within the greater matrix will be identified as requiring an increased cover of indigenous grasses and forbs. In this situation revegetation via direct seeding should be considered. Apart from any discrete areas where direct seeding is identified as a reestablishment option, planting nursery-grown plants will provide the best method of revegetation within the Racecourse Grassland, however direct seeding of herbs could be considered to reduce the overall costs of reestablishment. The determination of whether to plant or direct seed will lie with Council and/or their appointed contractor and should only be completed prior to a post burn assessment of native flora germination and if kangaroo numbers are managed.

Additional opportunities

Additional opportunities that should be explored in relation to revegetation and enhancement include, sourcing seed from local Council-managed reserves and roadsides to aid conservation of local genes; and the establishment of Seed Production Areas (SPAs) on Council-owned lands, such as existing reserves where suitable conditions occur (e.g. disturbed sites with low existing biodiversity value and low public-use value). These initiatives could greatly enhance the ability of Council to provide local provenance planting stock of desirable species which may not always be readily available commercially.

4.4 Biomass accumulation

The reserve currently contains a significant number of indigenous grasses, including Kangaroo Grass, Common Tussock-grass *Poa labillardierei* and Wallaby Grasses (*Rytidosperma* spp.) and many other species of subordinate grasses. If kangaroo grazing is removed it can be expected that following productive (average to above-average rainfall) years, grassland structure will become dense with accumulated grassy litter and little inter-tussock space or bare ground resulting in closed sward structure. The maintenance of an open sward structure is important for the persistence and reproduction of many small herbs that reside in the spaces between grassy tussocks, including some species that can decline in the absence of periodic biomass removal. The maintenance of open structure can be achieved through the targeted use of fire, slashing and grazing. The use of fire is considered preferable however, because when conducted effectively it completely removes grassy litter and promotes the regeneration and recruitment of indigenous species.

The process of biomass removal can also be important for fauna species that prefer open grasslands or mixed swards with both open and closed habitats. However, biomass control should also be managed cautiously to ensure that protective habitat is present for fauna refuge during and following biomass removal (i.e. the creation of a mosaic landscape) in order to ensure cover is available from predators that will exploit optimal 'open' hunting conditions following a burn.

Methods for biomass control

Biomass removal is a critical part of maintaining the reserve's floristic diversity. Burning should take place every two to three years. Pulse grazing by kangaroos could extend the required period of time between burns if completed in a compensatory manner. A biomass reduction program

consisting of the combination of burning and grazing may employ burning, followed by a rest year without biomass management, a year with a period of kangaroo grazing as biomass control, finally followed by another rest year before the cycle begins again. In dry periods, or if in conjunction with short term pulse grazing by kangaroos, burning can be reduced in frequency as biomass accumulation rates are expected to be lower. During particularly wet periods the most recent burn areas can revert to pre-burn litter levels relatively quickly, therefore management must also monitor these areas to ensure that they are re-burnt if necessary to avoid degrading the overall grassland values.

Burning should not be considered if kangaroo numbers with access to the reserve remain at current levels, as the grazing pressure provides a substantial biomass reduction regime. Burning areas of potential Seasonal Herbaceous Wetland should also be avoided. The effect of burning on component species of the reserve also remains largely unclear, due to a lack of detailed flora monitoring for common and rarer species. Anecdotally, it has been argued that autumn burns can be detrimental to colloquially termed 'leafy' Fireweeds (e.g. Floodplain Fireweed *Senecio campylocarpus*). It has also been scientifically determined that autumn burns can be detrimental to some species of common orchid. The large population of Floodplain Fireweed around the dam should be monitored if regular burning is to take place and management must take actions to ensure the fire regime at the Racecourse Grassland does not result in a significant population decline of this species. Further, frequent burning may also be detrimental to Snow Gums and protection of these species should be ensured.

Burning needs to respond to the presence of coarse woody debris at ground level as well as large old trees and stags. Protection of these important habitat features needs to be implemented pre burn and can be achieved by the provision of slashed breaks around individual features and preventing excessive candling of tree species during planned burns.

4.5 Line of sight thinning

The preservation of sight lines from both the main spectator viewing areas and the Stewards towers is essential for continued racing at the Hanging Rock Racecourse. Management therefore needs to consider how to achieve good sight lines while still preserving the significant ecological values of the Racecourse Grassland.

Methods for line of sight thinning

Consideration needs to be given to achieving the required sight lines while still preserving a good spread of tree species and life history stages. Early thinning is preferred so that tree establishment within sight lines is limited, rather than preserved through the removal of more significant older trees. However, thinning needs to be achieved while still considering the replacement of older declining individuals by new saplings and at times the removal of larger semi-mature saplings in order to promote a diverse spread of tree age may be required. Lopping of branches on older established trees may also be required at times and this should be completed in such a way as to preserve a healthy and safe tree structure. Thinning works must avoid impacting any trees considered by the Traditional Owners to be scarred.

Additional opportunities

The thinning of woody vegetation provides opportunity to enhance habitat value via the addition of coarse woody debris acquired from the thinning process. The placement of any woody debris

should be concentrated in areas where their protection and retention can be assured. Suitable areas may include areas around the edge of the dam or within the higher elevation areas of the site.

4.6 Public use

Public use of the Racecourse Grassland has been identified as low by the Hanging Rock rangers, especially in comparison to the remainder of the reserve. A general lack of infrastructure, including tracks and accompanying signage, is a major contributing factor to the lack of utilisation of the Racecourse Grassland by the public, with the majority of visitors oblivious to the many and varied values present within this area of the reserve. Opportunities exist to expand the existing network of walking tracks throughout the reserve to include access to the Racecourse Grassland, with increased directional signage at key points around the reserve likely to see additional visitors exploring the grassland area. Interpretive signage, similar to what is already present within the Racecourse Grassland (see image 3) would further serve a strong environmental education function, highlighting the diverse range of values present including the regionally significant grassland itself, the lowland population of Snow Gum's, the floristically diverse mud flat communities and the noteworthy canopy trees present in some parts, among others. Any additional infrastructure will need to be implemented in an environmentally sympathetic manner, with minimal impacts to native vegetation. A Construction Environmental Management Plan (CEMP) will need to be written and enforced during any infrastructure works throughout the Racecourse Grassland.

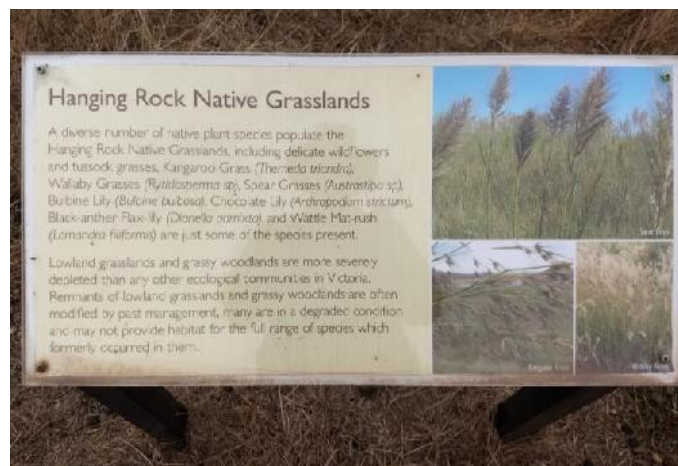


Image 3. Current interpretive signage within the Hanging Rock Grassland.

Methods for encouraging public use

Walking tracks and interpretive signage could be installed to encourage sensitive public use.

Additional opportunities

Interpretation of the effects of kangaroo grazing and burning could be presented to public to help to explain the reasons for management actions and garner public support for responsible ecological management.

4.7 Flora and fauna surveys and vegetation monitoring

While a number of flora and fauna surveys of the area have been completed over the years a detailed compilation of these surveys and confirmation of current taxonomy and species is

required. Flora surveys in spring within the reserve area will be completed to identify the complete range of flora currently present within the area of the Racecourse Grassland and provide a baseline for ongoing monitoring of the sites floral values.

Methods for flora and fauna surveys and vegetation monitoring

A monitoring program will be established that will consist of the recording of cover values for each zone bi-annually in spring and autumn using the Braun-Blanquet (1932) cover method. Covers within each of the zones will be estimated to the closest representative value for each of the identified structural features (see Table 1). These cover values will be accompanied by photo points (one established within each management zone) with photos taken seasonally from each photo point.

Table 1. Structural features that require recording and representative value identifiers.

Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody debris	Leaf litter	Rock	Soil crust	Bare ground
Indigenous Vegetation Cover			Exotic Vegetation Cover				Structural Components					
Representative Values:												
A – Absent or not observed;				2 – 6-25% projective foliage cover;								
R – Rare or solitary with negligible cover;				3 – 26-50% projective foliage cover;								
+ – <1% projective foliage cover;				4 – 51-75% projective foliage cover;								
1 – 1-5% projective foliage cover;				5 – 76-100% projective foliage cover;								

At intervals during the management plan opportunities will arise to document detailed flora records for parts of the reserve. Changes to vegetation structure and composition that result from biomass management and seasonal weather conditions provide the best survey opportunities, and these can be integrated into on-ground works to enable detailed compilation of flora data. For example, GPS coordinates of key high value flora patches within the reserve can be collected and presented on reserve maps and data uploaded to the VBA. Key focal areas of the reserve include ephemeral wetland habitat areas for wetland flora and densely grassed areas following ecological burns, which can reveal hidden diversity within the reserve.

The removal of grazing pressure also has the potential to increase the suitability of the habitat for a variety of fauna species. Nocturnal spotlight surveys should also be completed regularly to monitor changes in fauna use and identify if the changes are having any impact on vegetation structure and composition.

Additional opportunities

Good records exist for arboreal mammals including micro-bats, fish, larger ground dwelling mammals and birds. Records are currently limited for frogs, reptiles and smaller ground dwelling mammals. Targeted tile/paver based fauna surveys for this suite of species should be completed to fill the knowledge gap.

If burning is completed within the Racecourse Grassland the opportunity exists for a seed bank study to be undertaken in order to better understand the influence of burning of native species germination within the Racecourse Grassland.

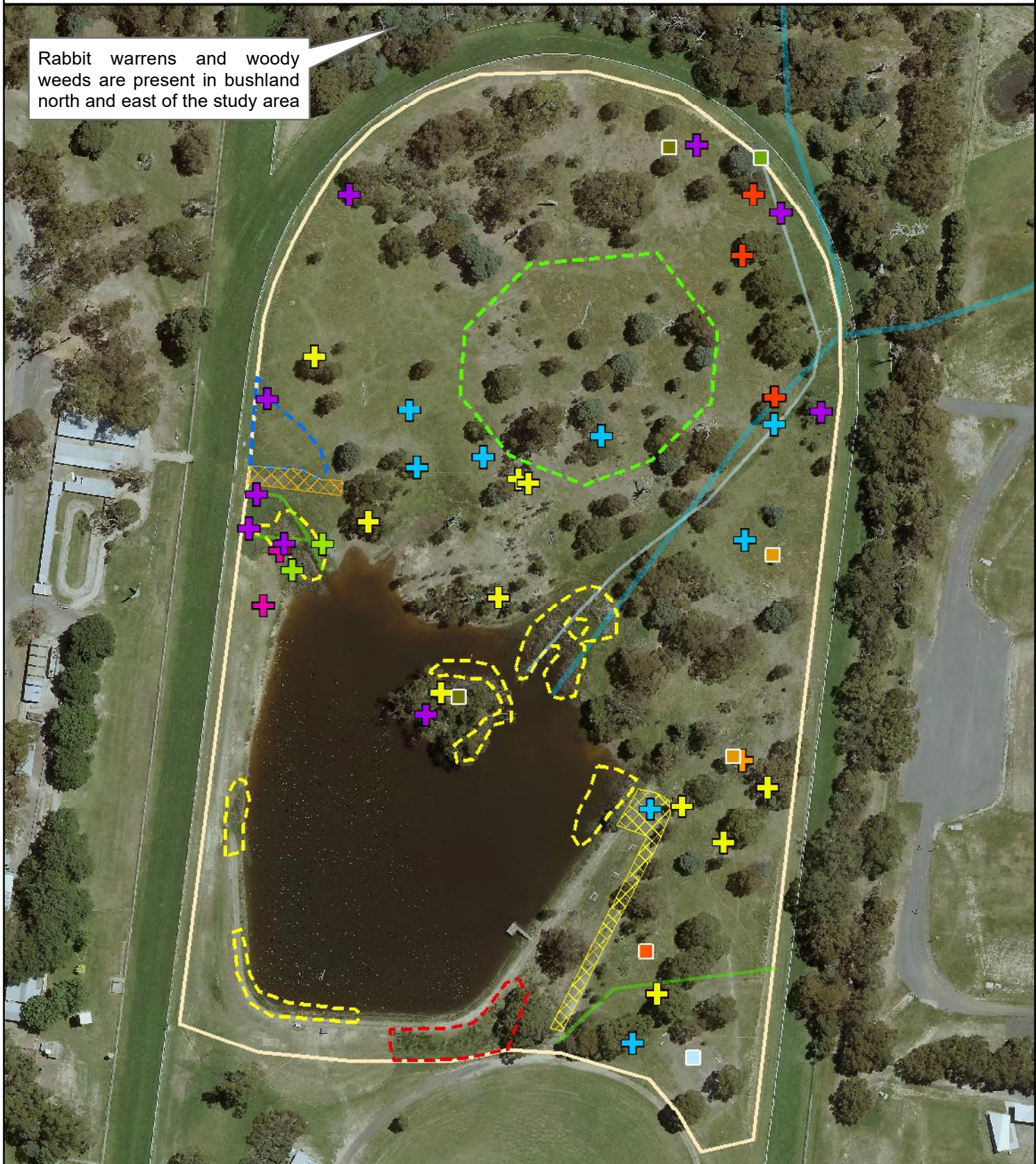
4.8 Changes to landscape hydrology

The wetland margins within the Racecourse Grassland are currently maintained by the hydrological changes associated with the use of the dam. The water requirements of the greater reserve including those of the race track surface result in the seasonal filling and subsequent draining of the dam within the grassland. This in turn creates conditions that support the persistence of mud mat and semi-aquatic flora. Private land immediately north of the reserve forms a significant portion of the dam catchment and supported via the pumping of water from smokers creek, provides the required inflows to the reserve's seasonal/ephemeral wetland system. Maintaining seasonal in-flows and the current wetting and drying cycles is critical to the preservation of the seasonal semi-aquatic flora on the dam margins.

The current ecological condition and floristic composition of areas surrounding the dam is supported by changing water levels. These changing water levels occur due to the current regime of seasonal pumping from the dam to satisfy the reserves water requirements. A change to current hydrological regime of the dam is likely to result in increased weed and Narrow-leaf Cumbungi invasion, eutrophication and habitat degradation. This would occur as a result of sedimentation or increased or decreased water levels that don't rise and fall seasonally.

The current water regime of seasonal pumping has resulted in a situation where areas of the Racecourse Grassland are able to support wetland floristics. The added diversity these wetland plants provide is a positive ecological outcome and there is no reason to change the current hydrological management of the dam. The hydrology of the local area will however be dependent on water availability as a result of local rainfall events combined with the water requirements of the race track surface. Artificial changes to local topography may also impact available water and increase the potential for sedimentation. These issues must be considered during strategic planning for the racecourses annual water requirements to ensure seasonal water level fluctuations and the preservation of biodiversity values within the reserve.

Figure 2. Land use disturbances and weed infestations at Hanging Rock Racecourse Grassland, Newham



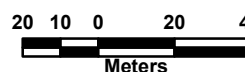
- Study area
- Exotic grassland
- Kangaroo camp
- Typha domingensis*
- Cytisus scoparius*
- Compacted gravel
- Embankment and track
- Channelized watercourse
- Swale drain
- Natural watercourse

Weed infestations

- + *Cretagus monogyna*
- + *Cytisus scoparius*
- + *Genista monspessulana*
- + *Rosa rubiginosa*
- + *Rubus anglocandicans*
- + *Salix cinerea*
- + *Ulex europaeus*

Disturbances

- + Stockpile
- + Soil mound
- + Warren
- + Rockpile
- + Pipe outlet



Scale 1: 2,000 (A4)
GDA 1994 MGA Zone 55

Map created 23 April 2019
Created by Geordie Scott-Walker
Report: 19021 - map version 1.0
File: J:\Jobs\2019\19021-Macedon Ranges\ShireCouncil-HangingRock RacecourseGrassland

Abzeco Pty. Ltd
Suite 1, 4 Brisbane Street
Eltham, Victoria 3095
Ph 03 9431 5444
www.abzeco.com.au

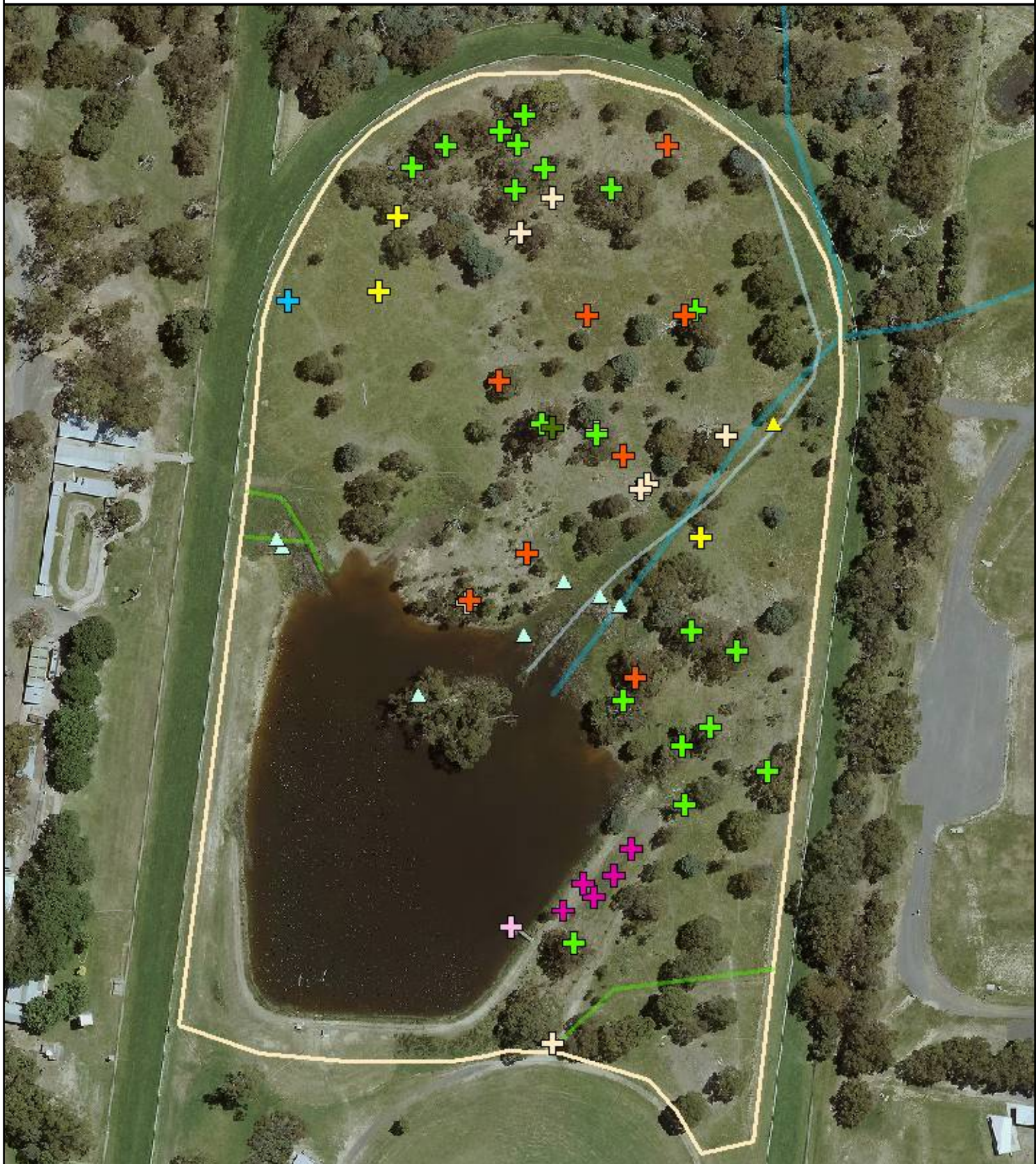


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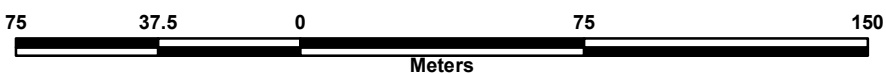
Note: location of watercourse indicative only

Figure 3. Site features and significant flora at Hanging Rock Racecourse Grassland, Newham



- | | | |
|------------------------------|------------------------|----------------|
| Study area | Features | Grassland sign |
| Channelized watercourse | Bench | Jetty |
| Swale drain | Coarse woody debris | Large logs |
| Natural watercourse | Grazing exclusion plot | Stag tree |
| Significant flora | Habitat tree | |
| <i>Coronidium gunnianum</i> | | |
| <i>Senecio campylocarpus</i> | | |

Map created 23 April 2019
Created by Geordie Scott-Walker
Report: 19021 - map version 1.1
File: J:\Jobs\2019\19021-Macedon Ranges\ShireCouncil-HangingRock RacecourseGrassland



Note: location of watercourse indicative only

Scale 1: 2,000 (A4)

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Abzeco Pty, Ltd
 Suite 1, 4 Brisbane Street
 Eltham, Victoria 3095
 Ph 03 9431 5444
 www.abzeco.com.au

5 Land management zones and directions for management

5.1 Land management zones and baseline conditions

For the five year period of this management plan the planning and implementation of works are structured by six primary land management zones, some of which support sub-zones (Figure 4).

All terrestrial zones will be provided biomass management for herbaceous and woody plants using fire, manual/chemical control, and by regulating kangaroo grazing. These actions will be supported by further enhancement through weed control and revegetation using locally suited herbaceous species. All significant flora of the reserve will be monitored and protected from disturbances such as inappropriate biomass and weed management practices. Flora and fauna surveys will be conducted to increase knowledge of the reserve's values and improve reserve management, and will include opportune times, such as wetter-than-average years, or following time-since-fire, to document habitat use by various species.

Each zone is briefly described below in terms of its structure, broad composition and management issues, and baseline condition is provided in accordance with the methodology of Section 4.1.5 of this report. The materials below therefore provide a baseline condition, against which future site condition can be assessed. Further assessments are to be completed as milestones are reached during the five year period of the management schedule outlined within this report and also upon project completion. Condition reviews will support an assessment of overall management effectiveness and help inform future planning.

A summary of the key land management actions required within each management zone is provided in Table 8.

5.1.1 Zone 1 – Grassland (0.73 ha)

The western low-lying plain supports a mostly treeless area of open grassy plain that receives moderate run-off from relatively elevated zones 2A and B. The zone is termed grassland because of its current low woody plant density and for its herb-rich understorey, as illustrated by grazing exclusion data (Just 2018). Zone 1 will be managed as derived grassland, maintained by the use of frequent fire and the active prevention of woody plant encroachment.

The current structure of the zone is a low, open grassland with moderate bare ground supporting three dominant grasses including Kangaroo Grass, Mat Grass and Sweet Vernal-grass. During springtime an array of wildflowers can be observed, although some species are currently suppressed by overgrazing by kangaroos. A small area of relatively low lying land in the south-west of Zone 1 appears to sustain heavy inundation during seasonally wet periods due to the natural drainage of the land form in combination with an adjacent embankment to the south, which is a man-made structure that functions as a vehicle track. This minor, paludal southern portion of the grassland supports relatively weedy vegetation tolerant of heavy waterlogging.

Table 2:- Recorded cover values for Zone 1.

	Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody Debris	Leaf litter	Rock	Soil crust	Bare ground
	Indigenous Vegetation Cover			Exotic Vegetation Cover					Structural Components				
Zone 1	1	1	+	+	1	2	+	A	R	1	R	1	2

NB. The cover categories used in the above table are adapted from Braun-Blanquet (1932).

Key: A – Absent or not observed; R – Rare or solitary with negligible cover; + – <1% projective foliage cover; 1 – 1-5% projective foliage cover; 2 – 6-25% projective foliage cover; 3 – 26-50% projective foliage cover; 4 – 51-75% projective foliage cover; 5 – 76-100% projective foliage cover;



Image 4 & 5. The western low-lying plain supports Zone 1 which is mostly treeless.

5.1.2 Zone 2 – Grassy woodland (3.47 ha)

A broad band of grassy woodland that spans the northern to south-western portions of the reserve makes up Zone 2, encompassing four sub-zones as depicted in Figure 4. The structure and function of each sub-zone is moderately uniform and their practical management will be relatively homogenous, however the distinction among sub-zones reflects natural features of the landscape that is well suited to planning and structuring on-ground vegetation management. For example, thinning, burning, weed control and revegetation among the four sub-zones of Zone 2 will be very similar – with the intent of maintaining a woodland formation – but works will be staged independently of one another to ensure manageability of the extensive woodland patch.

Zone 2 vegetation consists of open woodland characterised by mixed mature and regenerating Eucalypts with a variable groundstorey of herbaceous species dominated by grasses but with negligible cover of understorey shrubs. Scattered logs and several large stag trees are significant habitat features of Zone 2. Historically, the vegetation in a long undisturbed state plausibly formed a stand of Valley Grassy Forest (EVC 47), however, is now highly modified due to a combination of historic clearing, agricultural disturbances, overgrazing by kangaroos, weed invasion and understorey thinning.

Zones 2A and 2C occur on relatively elevated sites supporting shallow depth soils to basaltic parent material, with surface rock seldom visible. In these patches, character eucalypts include Snow Gum, Manna Gum and Candlebark, and significant remnant groundflora include: Scaly Buttons, Narrow Bitter-pea, Grey Parrot-pea and Creeping Bossiaea. Putative Eucalypt hybrids

appear restricted to sub-zone 2A, which appear on cursory investigation to involve combinations of Snow Gum, Manna Gum and Swamp Gum.

Zones 2B and 2D occupy relatively low lying sites and when compared to upslope zones receive greater run-off, support heavy, deeper soils and higher seasonal waterlogging potential. Sub-zones B and C support mixed eucalypts similar to upslope areas which includes Swamp Gum, large Narrow-leaf Peppermint trees and established Blackwoods and Silver Wattles. The southern portion of Zone 2D supports an historic swale drain that runs east-west, as well as a stockpile of racecourse management tools and equipment.

The use of biomass reduction across Zone 2 will be informed by the accumulation of herbaceous vegetation, which in turn depends on rainfall and grazing. The lower productivity of drier, shallow soils on the elevated areas of zones 2A and C may require less frequent biomass control than lower lying areas, and may also be relatively easier to manage for herbaceous weeds for the same reason.

Table 3. Recorded cover values for Zone 2.

	Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody debris	Leaf litter	Rock	Soil crust	Bare ground
	Indigenous Vegetation Cover			Exotic Vegetation Cover					Structural Components				
Zone 2A	1	+	2	R	1	2	1	A	1	2	R	+	2
Zone 2B	1	1	2	+	1	1	1	A	1	2	+	+	2
Zone 2C	1	1	2	1	1	1	1	A	1	2	1	1	2
Zone 2D	1	1	2	+	1	2	1	A	+	2	+	+	2

NB. The cover categories used in the above table are adapted from Braun-Blanquet (1932).

Key: A – Absent or not observed; R – Rare or solitary with negligible cover; + – <1% projective foliage cover; 1 – 1-5% projective foliage cover; 2 – 6-25% projective foliage cover; 3 – 26-50% projective foliage cover; 4 – 51-75% projective foliage cover; 5 – 76-100% projective foliage cover;

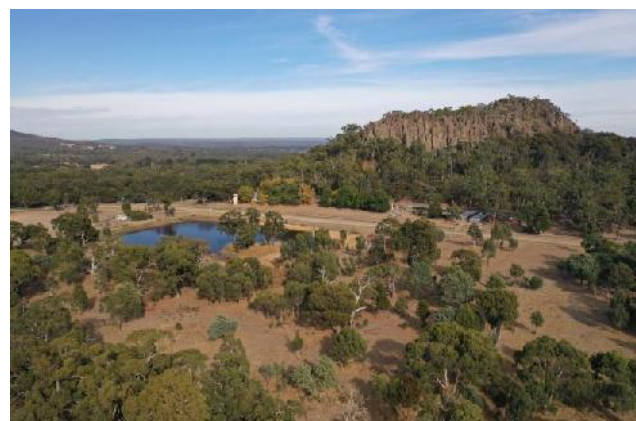


Image 6 & 7. Zone 2, a broad band of grassy woodland from ground level (left) and from above (right).

5.1.3 Zone 3 – Riparian channel (0.5 ha)

Zone 3 is defined by the eastern-most patch of alluvial channel and narrow margins supporting patchy Swamp Gum woodland, with strong riparian floristics such as robust sedges and Common Tussock-grass. The narrow band of vegetation derives from a drainage outfall in the north-east corner of the racecourse and through sub-surface flows along a drainage corridor further north-east (see Figure 4). The drainage-lines flowing into Zone 3 form the primary inflows of a relatively small catchment, which terminate at the dam (Zone 5) before any seepage enters the low gradient formation of Smokers Creek. In accordance with winter-wet conditions, the substrate of Zone 3 is likely to be seasonally waterlogged, possibly persisting through to warmer months in years of above-average rainfall.

Zone 3 will be managed as an open-woodland maintained primarily by use of low frequency fire, active thinning of eucalypt and wattle saplings, weed control and revegetation of riparian plants. A single, individual Pale Swamp Everlasting is present on the western margins of the zone in the central portion (see Figure 4), which must be preserved and provided sensitive management, particularly during weed control as a Briar Rose is growing through this plant. Additional Pale Everlasting plants may occur in the zone, and if any plants are located they will be mapped and protected.

Table 4. Recorded cover values for Zone 3.

	Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody debris	Leaf litter	Rock	Soil crust	Bare ground
	Indigenous Vegetation Cover			Exotic Vegetation Cover					Structural Components				
Zone 3	2	2	1	+	1	2	1	A	+	2	R	+	1

NB. The cover categories used in the above table are adapted from Braun-Blanquet (1932).

Key: A – Absent or not observed; R – Rare or solitary with negligible cover; + – <1% projective foliage cover; 1 – 1-5% projective foliage cover; 2 – 6-25% projective foliage cover; 3 – 26-50% projective foliage cover; 4 – 51-75% projective foliage cover; 5 – 76-100% projective foliage cover;



Image 8 & 9. Zone 3, an alluvial channel supporting patchy Swamp Gum woodland from above (left) and at ground level (right).

5.1.4 Zone 4 – Island woodlands (0.30 ha)

Two elevated mounds supporting woodland vegetation form the basis of Zone 4, located within and directly upslope of the reserve dam (Zone 5) and downslope of grassland and woodland zones (Zones 1, 2 and 3). Zone 4 is formed on artificial soil mounds created during dam dredging, which may be associated with the death of a large tree on Zone 4B. The high water mark of the dam surrounds the southern-most of the two islands (Zone 4B), and the perimeter of the northern island (Zone 4A) is probably only inundated during flood years, if at all.

Zone 4 is relatively weedy, but the vegetation patches also support indigenous species including an abundance of the Victorian ‘rare’ Floodplain Fireweed on the western and southern margins of Zone 4B near a large Blackberry infestation. A distinction between these island sub-zones is the current grazed (4A) and un-grazed (4B) states associated with the accessibility of these islands to kangaroos. The northern edge of Zone 4A supports indigenous ground flora currently suppressed by over-grazing, which provides an opportunity for natural regeneration through grazing control/restriction. Management of these zones will be relatively simple, but will include woody and herbaceous biomass control, weed control and revegetation.

Table 5. Recorded cover values for Zone 4.

	Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody debris	Leaf litter	Rock	Soil crust	Bare ground
	Indigenous Vegetation Cover			Exotic Vegetation Cover					Structural Components				
Zone 4A	2	1	2	2	+	1	1	A	2	1	R	R	+
Zone 4B	1	+	2	1	2	1	1	A	+	3	A	1	1

NB. The cover categories used in the above table are adapted from Braun-Blanquet (1932).

Key: A – Absent or not observed; R – Rare or solitary with negligible cover; + – <1% projective foliage cover; 1 – 1-5% projective foliage cover; 2 – 6-25% projective foliage cover; 3 – 26-50% projective foliage cover; 4 – 51-75% projective foliage cover; 5 – 76-100% projective foliage cover;



Image 10 & 11. Aerial images of Zone 4 showing the island and raised woodland.

5.1.5 Zone 5 – Mudflats and tall reeds (0.50 ha)

Zone 5 is formed of the northern margins of the reserve dam combined with narrow upslope verges, which are winter-wet run-on zones characterised by aquatic wetland species. The zone forms a restricted, hydrologically dependent habitat, supporting a relatively unique floristic assemblage. Common species include Prickfoot, Floodplain Fireweed, Small Mud-mat *Glossostigma elatinooides*, Creeping Knotweed *Persicaria prostrata*, Upright Water-milfoil *Myriophyllum crispatum*, Hollow Rush *Juncus amabilis*, Joint-leaf Rush *Juncus holoschoenus*, Common Sneezeweed *Centipeda cunninghamii*, Elatine Sneezeweed *Centipeda elatinooides* and Shining Pennywort *Hydrocotyle sibthorpioides*. The zone extent may vary in response to changes in hydrology on an annual basis, but is mapped according to the extent observed in March 2019, which presented good conditions for observing the mud-mat flora of this habitat in response to receding dam levels.

The vegetation structure and composition of Zone 5 is dependent on hydrological processes and is therefore susceptible to significant hydrology changes. The presence of large stands of Narrow-leaf Cumbungi may shift with changes to hydrology and sedimentation from upstream sources, and will therefore be monitored to ensure processes do not compromise seasonally inundated mud-mats and upslope areas. Management of Zone 5 will consist of monitoring Narrow-leaf Cumbungi distribution, maintenance of the current hydrology and avoiding significant disturbances and inappropriate human use of these areas for fishing.

Table 6. Recorded cover values for Zone 5.

	Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody debris	Leaf litter	Rock	Soil crust	Bare ground
	Indigenous Vegetation Cover			Exotic Vegetation Cover					Structural Components				
Zone 5	+	2	1	+	+	+	1	A	+	+	A	1	4

NB. The cover categories used in the above table are adapted from Braun-Blanquet (1932).

Key: A – Absent or not observed; R – Rare or solitary with negligible cover; + – <1% projective foliage cover; 1 – 1-5% projective foliage cover; 2 – 6-25% projective foliage cover; 3 – 26-50% projective foliage cover; 4 – 51-75% projective foliage cover; 5 – 76-100% projective foliage cover;



Image 12 & 13. Zone 5, the northern margins of the reserve dam combined with narrow upslope verges, which are winter-wet run-on zones characterised by aquatic wetland species

5.1.6 Zone 6 – Dam and public use areas (2.40 ha)

Zone 6 consists of the expansive reserve dam with its southern, eastern and western embankments, slashed outer margins and the eastern public use area, which includes a short jetty, public tables and seating and a gravel track running along the eastern boundary with Zone 2D. These highly disturbed areas support degraded exotic-dominated vegetation, including a dense infestation of English Broom on the southern outer-batter of the dam wall, however two large Eucalypts occupy the eastern outer-batter of the dam wall. The interior slopes of the dam carry a variety of low growing herbs, dense sedge clumps and several colonies of Narrow-leaf Cumbungi.

The dam and public use areas are open to a variety of low-impact recreational uses including fishing, picnicking and nature observation, which are compatible with the current vegetation and require low site maintenance to enable these uses. Management of Zone 6 is limited to amenity weed management, control of public uses to confine them to appropriate areas of Zone 6 and control their movement to and from the zone, and monitoring of Narrow-leaf Cumbungi, similar to Zone 5, to monitor its distribution and potential spread.

Table 7. Recorded cover values for Zone 6.

	Grass	Forb and graminoid	Tree and shrub	Woody	Perennial grasses	Annual and short lived grasses	Broadleaf	Geophytes	Coarse woody debris	Leaf litter	Rock	Soil crust	Bare ground
	Indigenous Vegetation Cover			Exotic Vegetation Cover					Structural Components				
Zone 6	+	2	+	2	1	1	1	A	+	+	+	1	3

NB. The cover categories used in the above table are adapted from Braun-Blanquet (1932).

Key: **A** – Absent or not observed; **R** – Rare or solitary with negligible cover; **+** – <1% projective foliage cover; **1** – 1-5% projective foliage cover; **2** – 6-25% projective foliage cover; **3** – 26-50% projective foliage cover; **4** – 51-75% projective foliage cover; **5** – 76-100% projective foliage cover;



Image 14 & 15. Zone 6, the expansive reserve dam with its southern, eastern and western embankments.

Table 8. Key land management actions required at Hanging Rock Racecourse Grassland Reserve.

Action		Management zone									
No.	Name	1 Grassland 0.73 ha	2 – Woodland 3.47 ha				3 Riparian Corridor 0.50 ha	4 Island Woodland 0.30 ha		5 Mudflats and Tall Reeds 0.50 ha	6 Dam Environs 2.40 ha
			A	B	C	D		A	B		
1	Grazing control	×	×	×	×	×	×				
2	Biomass control	×	×	×	×	×	×				
3	Line-of-sight thinning	×	×	×	×	×	×				×
4	Woody weed control [#]	×	×	×	×	×	×	×	×	×	×
5	Herbaceous weed control	×	×	×	×	×	×	×	×	×	
6	Revegetation	×	×	×	×	×	×	×	×		
7	Spring flora survey	×	×	×	×	×	×	×	×	×	×
8	Spotlight fauna survey	×	×	×	×	×	×	×	×	×	×
9	Tile/paver grid survey	×	×	×	×						
10	Rabbit warren fumigation [#]		×								
11	Infrastructure maintenance										×

[#] Woody weed infestations and rabbit warrens require treatment in woodland to the north and east of the racecourse.

Figure 4. Management zones and levels at Hanging Rock Racecourse Grassland, Newham

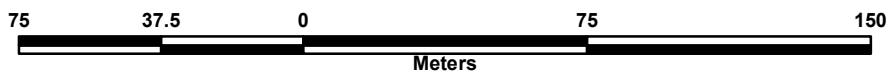


- Study area
- Channelized watercourse
- Swale drain
- Natural watercourse
- Contour (0.1m)

Management Zones

- | | |
|--|---|
| 1 - 0.73 ha | 3 - 0.50 ha |
| 2A - 0.89 ha | 4A - 0.17 ha |
| 2B - 1.03 ha | 4B - 0.13 ha |
| 2C - 0.83 ha | 5 - 0.50 ha |
| 2D - 0.72 ha | 6 - 2.4 ha |

Map created 23 April 2019
Created by Geordie Scott-Walker
Report: 19021 - map v1.1
File: J:\Jobs\2019\19021-Macedon Ranges\ShireCouncil-HangingRock RacecourseGrassland



Note: location of watercourse indicative only

Scale 1: 2,000 (A4)

GDA 1994 MGA Zone 55

Abzeco Pty. Ltd
 Suite 1, 4 Brisbane Street
 Eltham, Victoria 3095
 Ph 03 9431 5444
 www.abzeco.com.au



6 Project deliverables and schedule of works

The following targets and performance criteria provide a set of deliverables to be achieved by the end of five years of active management at the reserve. A works schedule is included to provide provisional guidance to Council and their appointed contractor/s.

6.1 Land management targets and performance criteria

The following targets apply to the entire Racecourse Grassland Reserve area.

Pest animal control and grazing management

- Prepare and coordinate an active vertebrate pest management program focussing on lagomorphs (rabbits and hares).
- Engage with neighbouring landholders to actively manage vertebrate pests in the local landscape.,
- Eliminate European Wasp nests and European Honey-bee hives by documenting, reporting and controlling all nests and hives.
- Prevent the establishment of new pest animals by documenting, reporting and controlling all new incursions, where feasible.
- Monitor, report and treat any new pest animal incursions.
- Ensure pest animal control does not result in soil disturbance.
- Document the reserve's kangaroo population including demographics (counts, sexes and breeding activity) and behaviours (points of movement into and out of the reserve, preferred areas and evidence of positive or negative grassland effects).

Firebreak maintenance

- Maintain compliance with fire safety requirements by installing and maintaining firebreaks to less than 100 mm herbaceous vegetation height where required.
- Ensure installation and maintenance of all firebreaks does not result in soil disturbance.
- Brushcut and/or spray around surface rocks where required prior to slashing the area.

Targeted surveys

- Increase the extent of knowledge on fauna species by commissioning surveys by a qualified and experienced zoologist either within council or externally, concentrating upon paver/tile surveys for small mammals, reptiles and amphibians.
- Increase the extent of knowledge on flora species by commissioning spring surveys by a qualified and experienced botanist, extending to any ephemeral wetland fauna – if and when conditions permit.
- Increase knowledge of flora populations by documenting the distribution of plants following each major site disturbance, such as planned burns and wet years, and display the records on a site flora map.
- Improve biodiversity management practices at the reserve by ensuring all targeted surveys include management recommendations.
- Submit flora and fauna observations to the Victorian Biodiversity Atlas.
- Ensure flora and fauna surveys do not result in soil disturbance.

Monitoring

- Establish a monitoring program consisting of a record of cover values for each zone bi-annually in spring and autumn using the Braun-Blanquet (1932) cover method.
- Establish marked photo points with a star picket marker and direction of view in each management zone.
- Take photos seasonally (four times a year approximately 3 months apart) from each established photo point.

Weed management

- Eliminate all woody weeds (less than 1% cover).
- Eliminate all bulbous (geophyte) weeds (less than 1% cover) *excluding* Onion Grass.
- Prevent the establishment of new exotic species within the reserve.
- Prevent an increase to the cover of weeds beyond current levels.
- Reduce and maintain perennial grassy weed cover below 10% in all zones except Zone 1.
- Reduce and maintain perennial grassy weed cover to less than 5% in Zone 1.
- Reduce and maintain broadleaf weed cover to less than 10% in all zones.
- Ensure no significant reduction to cover of native vegetation or significant flora species as a result of irresponsible weed management.
- Ensure all machinery, vehicle and equipment entering the site is clean of foreign soil, weed or other debris that may contain weed seeds or pathogens.
- Ensure weed management limits soil disturbance, excepting minor earthworks to reinstate semi-natural soil profile where wheel ruts exist.

Revegetation and management of grazing pressure

- Commission a landscape Kangaroo Management Plan and develop a grazing management strategy. If grazing is managed then:
 - Increase herb and non-grass graminoid cover in all zones to greater than 5% as well as overall herb and non-grass graminoid diversity.
 - Increase native grass cover throughout Zone 1 to greater than 40%.
 - Increase native grass cover throughout all zones except Zone 1 to greater than 30%.
 - Increase native forb cover throughout all zones except Zone 1 to greater than 10%.
 - Avoid the use of large augers or other heavy machinery during revegetation works, to avoid significant soil disturbance beyond what is necessary to complete revegetation.

Biomass control

- If grazing pressure is managed conduct ecological burns throughout each zone of the reserve at appropriate times to reduce biomass levels and create suitable recruitment gaps.
- Substitute burning where required by use of mowing, slashing and/or brushcutting with or without removing the cut materials to promote biodiversity and protect key assets including coarse wood debris and stag trees.

Rubbish control

- While rubbish is not a current issue management should prevent the accumulation of rubbish on site by documenting, reporting and disposing of all rubbish.
- Manage all other illegal activities by documenting and reporting incidents as they occur, and report illegal activities to Crime Stoppers (1800 333 000).
- Ensure rubbish removal does not result in soil disturbance.

6.2 Once-off site management requirements and standard operating procedure

Table 9 provides a work plan and standard operating procedures for a series of one off procedures required to be established. Actions will be completed subject to available resources and funding.

Table 9. One-off calendar of works and standard operating procedures for Hanging Rock Racecourse Grassland Reserve

Management action	Description	Timing of tasks	Estimated Cost
ONCE OFF SITE MANAGEMENT REQUIREMENTS – STANDARD OPERATING PROCEDURES			
The following actions only apply for the first year of the plan			
01 TARGETTED SURVEYS	<ul style="list-style-type: none"> ▪ Engage a suitably qualified and experienced professional zoologist or ecological consultancy to provide an assessment of Eastern Grey Kangaroo population behaviours, including individual counts and movements into and outside the reserve and develop a kangaroo management plan. ▪ Engage a suitably qualified and experienced professional zoologist or ecological consultancy to provide targeted fauna surveys using paver/tile plots. ▪ Engage a suitably qualified and experienced professional botanist or ecological consultancy to provide targeted flora surveys during spring. ▪ Ensure any survey equipment is removed from site at the completion of surveys to prevent illegal wildlife harvesting 	Timed to meet relevant standards and criteria for flora and fauna surveys as relevant to the reserve	Approximately \$5,000 for targeted flora surveys. Approximately \$15,000-\$25,000 for Kangaroo Management Plan.
02 MONITORING AND EVALUATION	<ul style="list-style-type: none"> ▪ Establish photo points and photo directions within each zone ▪ Record baseline cover information for each zone in spring 	Timed to meet relevant standards and criteria for flora and fauna monitoring as relevant to the reserve	Additional Hanging Rock Rangers time required for ongoing monitoring approximately 4 hrs.

6.3 Seasonal works and standard operating procedure

Table 10 provides a seasonal work plan and standard operating procedures that apply to the reserve for the duration of the plan. The table should be annotated where deviations occur and where improvements are made to the management process and methods used. A specific year-by-year schedule of works has not been included because on-ground works are based on supporting each burn event and the restoration schedule outlined in Table 2 in section 6.8, in addition to routine site maintenance tasks. The exact timing and approach to annual tasks will depend on the expertise of the operator, who shall be suitably qualified and experienced in the management of grassy ecosystems of southern Australia. The implementation of the schedule should also use the summary seasonal works calendar (Appendix 5) as a general guide for basic scheduling purposes. Actions will be completed subject to available resources and funding.

Table 10. Seasonal calendar of works and standard operating procedures for Hanging Rock Racecourse Grassland Reserve

Management action	Description	Timing of tasks	Estimated Cost
ANNUAL SITE MANAGEMENT REQUIREMENTS – STANDARD OPERATING PROCEDURES			
The following actions apply for every year of the plan			
01 WORKS PLANNING	<ul style="list-style-type: none"> ▪ Identify target areas for seasonal works, multi-year revegetation plans and burn areas ▪ Schedule all weed control actions and prepare designated revegetation areas ▪ Install photo points where significant works are proposed and collect baseline photographs and annotate with notes on site condition, including cover estimates and significant features ▪ Alert all personnel entering the reserve of the requirement for clean equipment, vehicles and machinery ▪ Induct all new personnel working at the reserve to local biodiversity values and significant species, vegetation and habitats to be protected during works ▪ Priority weeds – Appendix 3 ▪ Priority planting species – Appendix 4 – allow lead time for plant and seed procurement/harvesting and the requirements for seed storage, seed after-ripening and revegetation timing to fit weed control schedules and plant establishment needs ▪ Investigate opportunities for targeted surveys based on each year’s works 	<p><u>July:</u> initiation of annual works program</p> <p><u>October:</u> preparation for warm season works; spring flora and fauna surveys</p> <p><u>March:</u> preparation for cool season works</p> <p><u>June:</u> preparation for next financial year’s works</p>	<p>To be completed by Hanging Rock Ranger.</p> <p>Approximately 38hrs total time required.</p>

Management action	Description	Timing of tasks	Estimated cost
<p>02 PLANT AND SEED PROCUREMENT</p>	<ul style="list-style-type: none"> ▪ Place order for nursery grown plants or seed collection/supply, or schedule in-house seed collection from relevant sites and species; priority species recommended for revegetation are listed in Appendix 4, or other information sources where appropriate ▪ Provide long lag times to nurseries for difficult to source and grow species, discuss with nursery managers to determine which species to produce over relevant time-frames ▪ Periodically enquire with seed and plant suppliers for procurement updates to ensure appropriate service delivery and to reorganize revegetation works if necessary ▪ Hand collect native grass seed or use brush-harvester or other suitable method if greater amounts are required– ensure all equipment is clean and free of soil, pathogens and weed seed 	<p>Place nursery orders year round, with different species and timing of the order depending on the supplier’s requirements and desirable planting time to suit each species</p> <p>Schedule herb harvesting to suit the species of interest, varying widely for all potential species but typically focused around spring-summer</p> <p>Collect Kangaroo Grass seed from late December to January</p> <p>Collect other C4 grasses opportunistically throughout warmer months</p> <p>Collect native C3 grasses from spring to early summer</p>	<p>Approximately \$2,500 for supplying tube stock or sourcing seed.</p> <p>Additional 24-32hrs of Hanging Rock Rangers time required.</p>
<p>03 ROUTINE SITE MAINTENANCE TASKS</p>	<ul style="list-style-type: none"> ▪ Document, report and notify relevant parties of any illegal activities or vandalism, and collect all rubbish and dispose responsibly at an appropriate waste disposal facility (a 15 minute rubbish run at the start of weed control visit can help to keep on top of this task) ▪ Dispose of all rubbish off-site at a suitable waste refuse facility ▪ Document and report pest animal observations including, but not limited to European Wasp nests, European Honeybee hives, European Rabbit – control where possible ▪ Inspect fences for damages and repair where possible; document and report 	<p>Year-round for all tasks</p>	<p>Approximately \$2,500 for pest animal control.</p> <p>Additional 3-4hrs of Hanging Rock Rangers time required</p>

<p>04 WEED CONTROL</p>	<ul style="list-style-type: none"> ▪ Observe the management approaches outlined in Sections 4 and 5 as well as the targets and performance criteria of Section 6.1 ▪ Prioritise weed control in the following areas: <ul style="list-style-type: none"> - Recently burnt or slashed - Scheduled for biomass control - Planned for revegetation within 12-24 months - Revegetated areas subject to maintenance - Maintenance of edges/tidy areas – especially Zone 1 - Seasonal fire breaks/reserve edges that are often subject to edge effects and high rates of weed growth ▪ Priority weeds as per Appendix 3; focusing on woody weeds perennial grasses and herbs and geophytes ▪ Annual and short-lived weeds to be controlled on an as-needs basis as part of revegetation during site preparation and maintenance of establishing plantings/sowings (including Sweet Vernal-grass and Yorkshire Fog) ▪ Apply herbicides or chip out/hand pull individuals or patches of plants depending on resource availability, while minimising soil disturbance ▪ Select herbicides that are relevant to the situation, taking care to avoid residual herbicides if direct seeding or planting the area or if it poses unacceptable risk to indigenous flora ▪ Woody weeds: small plants can generally be hand pulled year-round; larger plants can be spot sprayed or cut-paint depending on plant size ▪ Ensure all persons conducting weed control are familiar with local flora and are aware of the risks of misidentifying indigenous flora, especially during post-burn follow-up. ▪ Refer to Appendix 5 – Seasonal works calendar for provisional weed control timing 	<p>Year round treatment ideally prior to flowering and seed set</p> <p>C3 grasses and many annual weeds require treatment during the cool-season</p> <p>C4 grasses and late-spring/summer annuals require treatment during the warm-season; however good spring-summer rains will allow for control of C3 grasses and spring germinating annuals</p>	<p>Approximately \$7,500.</p> <p>Additional Hanging Rock Rangers time required for planning and monitoring approximately 8hrs.</p>
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<p>05</p> <p>FIRE BREAK INSTALLATION AND EDGE MAINTENANCE</p>	<ul style="list-style-type: none"> ▪ Install firebreaks to Council standard in the lead up to planned burns and prior to the declared fire danger period ▪ Remove rubbish from firebreaks prior to or during firebreak installation, taking care during slashing or brushcutting not to disperse plastic or other materials ▪ Avoid negative impacts to native vegetation by allowing time for seed set prior to mowing, harvesting any 'wasted' seed from plants to re-disperse through the site or store for use in revegetation at a later time ▪ Where possible, avoid cutting native plants below 100 mm height but ensure compliance with Council's minimum standards ▪ Avoid use of brushcutting with grass-cutting cord if this will disperse weed seed ▪ Use a catcher and remove cut grass from high quality areas to provide the benefit of biomass removal; dispose of materials off-site or in a suitably located waste refuse area, or add slashed materials to the proposed burn area ▪ Document and report all firebreaks to Council for formal acceptance 	<p>Installation of firebreaks is seasonal: complete prior to commencement of the fire danger period; recut if good summer rains promote significant plant growth</p> <p>Installation of planned burn firebreaks is dependent on the timing of planned burns but typically within 2 weeks of the proposed burn event</p> <p>Edge maintenance within all zones is year-round, ensuring fence lines and access areas are clear of tall weeds and grasses.</p>	<p>Approximately \$1,000</p> <p>Additional 1-2hrs of Hanging Rock Rangers time required</p>
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<p>06 PLANNED BURNING</p>	<ul style="list-style-type: none"> ▪ On the day of the burn, remove all rubbish from planned burning areas ▪ Burn to remove surface biomass of all vegetation ▪ Ensure the protection of significant coarse woody debris as well as live and standing stag trees by installing slashed breaks around them. Particular attention paid to the protection of Snow Gums. ▪ Ensure the protection of large old trees and Snow Gums by limiting ignition of intermediate and overstorey bark fuels referred to as candling. ▪ Complement burn effectiveness through suitably timed pre-burn weed control of all weeds; with taller weeds dropped to ground level to increase fuel combustion (e.g. Brassicas and Wild Oats are good to cut and drop using secateurs, brushcutter or slasher to reduce the release of seeds after the burn if they are left upright) ▪ Support all planned burns with thorough, detailed and diligent post-burn follow-up of weeds and revegetation where appropriate. ▪ If burning is not possible, consider use of substitute biomass control methods 	<p>Spring burns – estimated to take place between October and December prior to the fire danger period unless a permit allows otherwise; generally can't be completed prior to October unless fuel is cured and dry conditions result in low fuel moisture during winter-early spring.</p> <p>Autumn burns – can take place from February through June but dependent on seasonal climate, biomass levels and fire danger period restrictions.</p>	<p>Approximately \$10,000-\$15,000 per burn required. Additional Hanging Rock Rangers time required for planning and notification approximately 16hrs.</p>
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<p>07 REVEGETATION</p>	<p>SITE PREPARATION GUIDELINES</p> <ul style="list-style-type: none"> ▪ Prepare revegetation areas by clearing all undesirable vegetation, including ruderal native plants and leaf litter where possible ▪ Provide multiple rounds of weed control prior to revegetation, ideally staged over several years but at the least inclusive of two full treatments across a productive growing period where germination and/or weed regrowth occurs, especially important for species with robust root systems such as bulbs, corms and rhizomes ▪ Disturb planting and sowing areas where possible to promote weed recruitment and enable effective weed treatments ▪ Remove leaf litter using heavy rakes or other devices to open bare ground and stimulate weed recruitment for control <p>PLANTING GUIDELINES</p> <ul style="list-style-type: none"> ▪ To prepare for planting, water the planting holes prior to installing plants to encourage a slurry and reduce air pockets ▪ During warmer months, anticipate dry soil conditions and carry out pre-planting digging and watering of the planting holes ▪ Provide all plantings follow-up watering at least once in the fortnight following planting, and at a greater frequency during dry conditions ▪ Monitor rainfall at weather stations near planting sites to inform supplementary watering; complement weather readings by inspecting site conditions to verify local precipitation ▪ Do not plant into heavily waterlogged soils except for grassy wetland species 	<p>Year round: dependent on planting area, species and site preparation requirements.</p> <p>This task is dependent upon burning and herbivore exclusion as these tasks may result in significant natural recruitment.</p> <p>Revegetation numbers and timing is required to be assessed and determined based upon the natural recruitment achieved through burning and herbivore exclusion. If burning and herbivore exclusion result in significant natural recruitment additional revegetation may not be required or may only be required in reduced numbers.</p> <p>Revegetation should only be completed if absolutely necessary as a means of reducing the required weed control inputs.</p>	<p>Approximately \$5,000 for planting tube stock or sourcing seed.</p> <p>Additional 3-4hrs of Hanging Rock Rangers time required.</p>
<p>08 TARGETTED SURVEYS</p>	<ul style="list-style-type: none"> ▪ Document Eastern Grey Kangaroo population behaviours, including individual counts and movements into and outside the reserve. ▪ Document flora observations following any site disturbances and collate records with annual reporting 	<p>Timed to meet relevant standards and criteria for flora and fauna surveys as relevant to the reserve</p>	<p>Additional Hanging Rock Rangers time required for ongoing updating of survey information approximately 16 hrs.</p>

<p>09 MONITORING AND EVALUATION</p>	<ul style="list-style-type: none"> ▪ Update site management in response to survey results and management recommendations of survey reports ▪ Update the VBA with new survey data ▪ Review burn results over the initial weeks after each burn to determine effectiveness and to inform weed control and revegetation actions ▪ Capture photo from each photo point four times a year ▪ Record cover information for each zone two times a year ▪ Revisit any photo points throughout the year to document ongoing site changes both in response to management actions and in response to seasonal conditions ▪ Summarise all works activities and conduct round-table discussions amongst project staff to evaluate seasonal outcomes and inform future works. 	<p>Capture photos from photo points at the start of each season (March, June, September, December)</p> <p>Record cover information for each zone at the start of spring and autumn (March and September)</p> <p>Evaluate weed control effectiveness at regular intervals following each major treatment, taking care to recognise some herbicides take substantial time to take full effect</p> <p>Evaluate all works conducted during winter-spring-summer in March</p> <p>Evaluate all works from March to May in June</p>	<p>Additional Hanging Rock Rangers time required for ongoing monitoring approximately 20 hrs.</p>
<p>10 FIVE YEAR PROGRAM REVIEW</p>	<ul style="list-style-type: none"> ▪ Conduct a review of site management outcomes based on documentation of all on-ground works and an ecological assessment of current site condition. Provide a summary of findings and recommendations for scope of works for the preparation of new management plan ▪ Review the status of resident populations of rare or threatened flora, fauna and the condition of each ecological community during the five year review to inform future management of these values ▪ Review the status of threatening processes and key site threats, including but not limited to pest plants and animals, biomass levels, macropod populations and local hydrology changes ▪ Disseminate all reporting to relevant stakeholders 	<p>Collate historic records, conduct site assessment and round-table discussions amongst project personnel by June 30, 2024.</p>	<p>Additional Hanging Rock Rangers time required for program review approximately 8 hrs.</p>

7 Project management, risks and monitoring

The plan will commence upon formal approval from the responsible authority. Implementation will rely on the appointed Council officer or contractor, requiring that resources provided to the reserve are assigned to specific tasks to enable successful achievement of the project goals. The appointed project staff will need to ensure their internal systems can be adapted to meet the demands of site management and restoration works required by this plan. Management success will depend significantly on the resources made available to the project and the knowledge and experience of appointed Council personnel or contractor/s. Project personnel are encouraged to take an adaptive approach to their work to best cope with the surprises and challenges that inevitably arise on ecological management projects.

Monitoring and evaluation

Project monitoring is a standard component of any ecological management project. The management of vegetation and habitats at the reserve is dependent on regular site visitation to record and document then respond to on-site conditions, including new weed and pest incursions, results of weed control actions, rubbish dumping, changing seasons and ecological 'surprises', which are part of any site surveillance program.

At the completion of the five years of on-ground works Council will review the outcomes of site management and formulate a new plan. The new plan should develop key management directions based on the success or otherwise of the restoration plan in effectively increasing the site's floristic diversity, maintenance of flora and fauna habitats, controlling pest plant and animal invasions and the accumulation of biomass.

Project delivery

Implementation of this plan will ensure high threat environmental weeds are reduced or maintained at low levels throughout the five year management period. Localised infestations will be eliminated and many of the high threat weeds currently abundant will be significantly reduced in cover and abundance. Revegetation will ensure an increase in native vegetation cover that is commensurate with low weed cover. During this period natural processes will continue through the management of grazing pressure and the active use of fire and other forms of biomass control. Assuming that responsible operational practices and effective monitoring is applied to inform management decisions native species are expected to benefit from the management regime. The guidelines of this plan are broadly circumscribed to enable a flexible approach to on-ground works, while the targets and specific measures will ensure accountability for the delivery of project outcomes.

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Appendix 1. Flora species records

Flora species recorded at Hanging Rock Racecourse Grassland on 29 March 2019.

The status of the species listed in the table below adopts the following classification schemes:

- conservation status under the Victorian Advisory List (DEPI 2014);
- noxious weeds within the Port Phillip and Westernport Catchment Region under the *Victorian Catchment and Land Protection Act 1996*; and,
- Commonwealth listed Weeds of National Significance and other introduced plants that threaten biodiversity (DOEE 2019).

LEGEND:	
* introduced/exotic species	L listed as threatened under the Victorian <i>Flora and Fauna Guarantee Act 1988</i>
# non-indigenous native species	C regionally controlled noxious weed
r rare in Victoria	R regionally restricted noxious weed
v vulnerable in Victoria	W Weed of National Significance

Origin	Scientific Name	Common Name	Status
	<i>Acacia dealbata</i> subsp. <i>dealbata</i>	Silver Wattle	
	<i>Acacia melanoxylon</i>	Blackwood	
	<i>Acacia nanodealbata</i>	Dwarf Silver Wattle	r
	<i>Acaena ovina</i>	Australian Sheep's Burr	
*	<i>Acetosella vulgaris</i>	Sheep Sorrel	
	<i>Acrotriche prostrata</i>	Trailing Ground-berry	
*	<i>Agrostis capillaris</i>	Brown-top Bent	
	<i>Alisma plantago-aquatica</i>	Water Plantain	
	<i>Alternanthera denticulata</i> s.l.	Lesser Joyweed	
	<i>Amphibromus</i> spp.	Swamp Wallaby-grass	
*	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	
	<i>Arthropodium strictum</i> s.l.	Chocolate Lily	
	<i>Austrostipa rudis</i>	Veined Spear-grass	
	<i>Bossiaea prostrata</i>	Creeping Bossiaea	
*	<i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome	
	<i>Carex appressa</i>	Tall Sedge	
	<i>Carex</i> spp.	Sedge	
*	<i>Centaurium erythraea</i>	Common Centaury	
	<i>Centella cordifolia</i>	Centella	
	<i>Centipeda cunninghamii</i>	Common Sneezeweed	
	<i>Centipeda elatinoides</i>	Elatine Sneezeweed	
	<i>Centipeda minima</i> subsp. <i>minima</i> s.s.	Spreading Sneezeweed	
*	<i>Cirsium vulgare</i>	Spear Thistle	R
*	<i>Cordyline australis</i>	New Zealand Cabbage-tree	
	<i>Coronidium gunnianum</i>	Pale Swamp Everlasting	r
	<i>Crassula helmsii</i>	Swamp Crassula	
*	<i>Crassula natans</i> var. <i>minus</i>	Water Crassula	
*	<i>Crataegus monogyna</i>	Hawthorn	R

Origin	Scientific Name	Common Name	Status
*	<i>Cynodon dactylon</i>	Couch	
*	<i>Cyperus eragrostis</i>	Drain Flat-sedge	
	<i>Cyperus lucidus</i>	Leafy Flat-sedge	
*	<i>Cytisus scoparius</i>	English Broom	R
	<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea	
	<i>Dillwynia cinerascens</i> s.l.	Grey Parrot-pea	
	<i>Dysphania pumilio</i>	Clammy Goosefoot	
	<i>Eleocharis acuta</i>	Common Spike-sedge	
	<i>Eleocharis sphacelata</i>	Tall Spike-sedge	
	<i>Epilobium hirtigerum</i>	Hairy Willow-herb	
	<i>Eragrostis brownii</i>	Common Love-grass	
	<i>Eryngium vesiculosum</i>	Prickfoot	
	<i>Eucalyptus ovata</i>	Swamp Gum	
	<i>Eucalyptus pauciflora</i>	Snow Gum	
	<i>Eucalyptus radiata</i> s.l.	Narrow-leaf Peppermint	
	<i>Eucalyptus rubida</i>	Candlebark	
	<i>Eucalyptus viminalis</i>	Manna Gum	
	<i>Euchiton involucratus</i> s.l.	Common Cudweed	
*	<i>Genista monspessulana</i>	Montpellier Broom	R
	<i>Geranium</i> sp. 5	Naked Crane's-bill	
*	<i>Glossostigma elatinoides</i>	Small Mud-mat	
	<i>Glyceria australis</i>	Australian Sweet-grass	
	<i>Gonocarpus tetragynus</i>	Common Raspwort	
	<i>Haloragis heterophylla</i>	Varied Raspwort	
	<i>Helichrysum luteoalbum</i>	Jersey Cudweed	
	<i>Hemarthria uncinata</i> var. <i>uncinata</i>	Mat Grass	
*	<i>Holcus lanatus</i>	Yorkshire Fog	
	<i>Hydrocotyle sibthorpioides</i>	Shining Pennywort	
	<i>Hypericum gramineum</i> spp. agg.	Small St John's Wort	
*	<i>Hypochaeris radicata</i>	Flatweed	
	<i>Isolepis cernua</i>	Nodding Club-sedge	
*	<i>Isotoma fluviatilis</i> subsp. <i>australis</i>	Swamp Isotome	
	<i>Isotoma tridens</i>	Hypsela	
	<i>Juncus amabilis</i>	Hollow Rush	
*	<i>Juncus articulatus</i> subsp. <i>articulatus</i>	Jointed Rush	
	<i>Juncus gregiflorus</i>	Green Rush	
	<i>Juncus holoschoenus</i>	Joint-leaf Rush	
*	<i>Juncus pallidus</i>	Pale Rush	
	<i>Juncus subsecundus</i>	Finger Rush	
	<i>Lachnagrostis filiformis</i> s.l.	Common Blown-grass	
*	<i>Lactuca serriola</i>	Prickly Lettuce	
*	<i>Leontodon saxatilis</i> subsp. <i>saxatilis</i>	Hairy Hawkbit	
	<i>Leptorhynchus squamatus</i>	Scaly Buttons	
	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush	
	<i>Lomandra longifolia</i> subsp. <i>longifolia</i>	Spiny-headed Mat-rush	
*	<i>Lysimachia arvensis</i> (Red-flowered variant)	Scarlet Pimpernel	
	<i>Lythrum hyssopifolia</i>	Small Loosestrife	

Origin	Scientific Name	Common Name	Status
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	
*	<i>Modiola caroliniana</i>	Red-flower Mallow	
	<i>Myriophyllum crispatum</i>	Upright Water-milfoil	
	<i>Oxalis exilis</i>	Shade Wood-sorrel	
*	<i>Paspalum dilatatum</i>	Paspalum	
	<i>Persicaria decipiens</i>	Slender Knotweed	
	<i>Persicaria prostrata</i>	Creeping Knotweed	
	<i>Pimelea humilis</i>	Common Rice-flower	
*	<i>Plantago coronopus</i>	Buck's-horn Plantain	
*	<i>Plantago lanceolata</i>	Ribwort	
	<i>Poa labillardierei</i>	Common Tussock-grass	
*	<i>Poa pratensis</i>	Kentucky Blue-grass	
	<i>Poa sieberiana</i>	Grey Tussock-grass	
*	<i>Prunella vulgaris</i>	Self-heal	
*	<i>Rosa rubiginosa</i>	Sweet Briar	C
*	<i>Rubus anglocandicans</i>	Common Blackberry	C
*	<i>Rumex conglomeratus</i>	Clustered Dock	
*	<i>Rumex crispus</i>	Curled Dock	
	<i>Rytidosperma geniculatum</i>	Kneed Wallaby-grass	
*	<i>Salix X reichardtii</i>	Pussy Willow	
	<i>Senecio campylocarpus</i>	Floodplain Fireweed	r
	<i>Senecio minimus</i>	Shrubby Fireweed	
	<i>Senecio quadridentatus</i>	Cotton Fireweed	
	<i>Solanum laciniatum</i>	Large Kangaroo Apple	
*	<i>Solanum nigrum</i> s.l.	Black Nightshade	
*	<i>Sonchus asper</i> s.l.	Rough Sow-thistle	
*	<i>Sonchus oleraceus</i>	Common Sow-thistle	
*	<i>Taraxacum officinale</i> spp. agg.	Garden Dandelion	
	<i>Themeda triandra</i>	Kangaroo Grass	
*	<i>Trifolium repens</i> var. <i>repens</i>	White Clover	
	<i>Typha domingensis</i>	Narrow-leaf Cumbungi	
*	<i>Ulex europaeus</i>	Gorse	C
	<i>Veronica gracilis</i>	Slender Speedwell	

Appendix 2. Fauna species records

Fauna species recorded at Hanging Rock Racecourse Grassland on 29 March 2019.

The status of the species listed in the table below adopts the following classification schemes:

- conservation status under the Victorian Advisory List (DSE 2009, 2013);
- noxious weeds within the Port Phillip and Westernport Catchment Region under the *Victorian Catchment and Land Protection Act 1996*; and,
- Commonwealth listed invasive species that threatens biodiversity (DOEE 2019).

LEGEND:	
* introduced/exotic species	CR listed as critically endangered in Australia
v listed as vulnerable in Victoria	L listed as threatened in Victoria
e listed as endangered in Victoria	C declared established pest animal in Victoria
cr listed as critically endangered in Victoria	I invasive species threatening biodiversity

Origin	Scientific Name	Common Name	Status
	<i>Porphyrio melanotus</i>	Australasian Swamphen	
	<i>Cracticus tibicen</i>	Australian Magpie	
	<i>Chenonetta jubata</i>	Australian Wood Duck	
*	<i>Salmo trutta</i>	Brown Trout	
	<i>Platycercus elegans</i>	Crimson Rosella	
	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	
	<i>Fulica atra</i>	Eurasian Coot	
*	<i>Oryctolagus cuniculus</i>	European Rabbit	I, C
	<i>Phascolarctos cinereus</i>	Koala	
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	
	<i>Grallina cyanoleuca</i>	Magpie-lark	
	<i>Strepera graculina</i>	Pied Currawong	
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis	
	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	
	<i>Aquila audax</i>	Wedge-tailed Eagle	
	<i>Egretta novaehollandiae</i>	White-faced Heron	

Appendix 3. High threat weeds

The determinations of High Threat status were made with consideration to the latest Advisory List for Weeds in Victoria (White *et al.* 2018). The estimated likelihood of elimination was drawn from on-ground experience working in grassy ecosystem management, and entails the reduction and maintenance of infestations to less than 1% cover. Recommended control methods for each weed type are generic and the nominated treatment method should be chosen in accordance with species-specific biology, seasonal growth patterns and local conditions, and on a case-by-case basis.

Note that listed weed species listed below include historic records from the Racecourse Grassland that were not visible during the site assessment, as denoted by the dagger (†) symbol. New species recorded within the reserve can be added to the list below under relevant life-form categories.

Reproductive materials of all weed species listed below should be removed and destroyed by burning or deep burial.

GEOPHYTES (BULBOUS SPECIES)		
Hand remove plants year-round, being careful to remove all aerial and below-ground bulbs that may be present. Treat dense patches with Group B and Group M mode-of-action herbicides during late winter-early spring during the bulb-exhaustion phase.		
Species	Common Name	Likelihood of Elimination
NO HIGH THREAT GEOPHYTES RECORDED FROM THE SITE		
NB. Onion Weed <i>Romulea rosea</i> is present but not considered practicable to eliminate.		
WOODY WEEDS		
Hand remove seedlings year-round, taking care not to break any primary roots that can regenerate. Treat established plants with Group I or combined Group M-Group B herbicides during active growth. Cut-and-paint or drill-and-fill larger trees and shrubs with few basal stems.		
Species	Common Name	Likelihood of Elimination
<i>Crataegus monogyna</i>	Hawthorn	High
<i>Cytisus scoparius</i>	English Broom	High
<i>Genista monspessulana</i> †	Montpellier Broom	High
<i>Prunus</i> spp.†	Prunus	High
<i>Rosa rubiginosa</i>	Sweet Briar	High
<i>Rubus anglocandicans</i>	Common Blackberry	High
<i>Salix X reichardtii</i>	Pussy Willow	High
<i>Ulex europaeus</i>	Gorse	High

PERENNIAL GRASSES

Hand remove plants growing close to indigenous plants or treat with selective herbicides and cautious spraying techniques that will not impact desirable indigenous plants. Preferentially spray during the early months following biomass control and consider brushcutting rank grasses low to the ground to promote regrowth suitable for spraying. C3 grasses can be treated year-round provided good foliage is present; limit control of C4 grasses (denoted by the double-dagger [‡] symbol) to warmer months, primarily November to March. Sweet Vernal-grass *Anthoxanthus odoratum* and Yorkshire Fog *Holcus lanatus* are for all practical purposes categorized as annual to biennial weeds to be treated in accordance with guidelines for annual weeds as outlined in Section 6.3 of the report.

Species	Common Name	Likelihood of Elimination
<i>Agrostis capillaris</i> var. <i>capillaris</i>	Brown-top Bent	Low
<i>Cenchrus clandestinus</i>	Kikuyu	High
<i>Cynodon dactylon</i>	Couch	High
<i>Dactylis glomerata</i>	Cocksfoot	High
<i>Festuca arundinaceae</i> †	Tall Fescue	High
<i>Paspalum dilatatum</i>	Paspalum	High
<i>Poa pratensis</i>	Kentucky Blue-grass	Low

GRAMINOIDS (NON-GRASS)

Hand remove plants growing close to indigenous plants or treat with selective herbicides and cautious spraying techniques that will not impact desirable plants.

Species	Common Name	Likelihood of Elimination
<i>Cyperus eragrostis</i>	Drain Flat-sedge	Low
<i>Juncus articulatus</i> ssp. <i>articulatus</i>	Jointed Rush	Low

PERENNIAL AND BIENNIAL BROADLEAF WEEDS

Hand remove plants growing close to indigenous plants or treat with selective herbicides and cautious spraying techniques that will not impact desirable plants.

Species	Common Name	Likelihood of Elimination
<i>Acetosella vulgaris</i>	Sheep Sorrell	High
<i>Arctotheca calendula</i> †	Cape Weed	Low
<i>Cirsium vulgare</i>	Spear Thistle	Low
<i>Cordyline australis</i>	New Zealand Cabbage-tree	High
<i>Hypochaeris radicata</i>	Flatweed	High
<i>Lactuca serriola</i>	Prickly Lettuce	Low
<i>Leontodon saxatillis</i> ssp. <i>saxatillis</i> †	Hairy Hawkbit	Low
<i>Modiola caroliniana</i>	Red-flower Mallow	Low
<i>Myosotis discolor</i>	Yellow-and-blue Foreget-me-not	High
<i>Plantago coronopus</i>	Buck's-horn Plantain	High
<i>Plantago lanceolata</i>	Ribwort	Low
<i>Prunella vulgaris</i>	Self-heal	High
<i>Rumex conglomeratus</i>	Clustered Dock	High
<i>Rumex crispus</i>	Curled Dock	Low
<i>Solanum nigrum</i>	Black Nightshade	Low
<i>Taraxacum officinale</i> spp. agg.	Garden Dandelion	High
<i>Tragopogon porrifolius</i> ssp. <i>porrifolius</i> †	Salsify	High
<i>Trifolium repens</i> var. <i>repens</i>	White Clover	High
<i>Vicia sativa</i> †	Common Vetch	Low

Appendix 4. Indigenous flora suitable for revegetation

The availability of revegetation stock will depend on local and regional native plant and seed suppliers. Seed can also be collected under permit from local Council-managed reserves or other sites with relevant approvals in place. Collection of plant materials including seeds from public land in Victoria requires a permit under the *Flora and Fauna Guarantee Act 1988*. Grass species denoted by the dagger (†) symbol support a C4 photosynthetic pathway.

Species Name	Common Name	Suitable Zones	Habitat Fidelity
INDIGENOUS GRASSES AND GRAMINOIDS			
<i>Austrostipa bigeniculata</i>	Kneed Spear-grass	1, 2, 3, 4	Dry
<i>Austrostipa rudis</i> ssp. <i>rudis</i>	Veined Spear-grass	1, 2, 3, 4	Dry
<i>Amphibromus nervosus</i>	Common Swamp Wallaby-grass	4, 5, 6	Wet
<i>Anthosachne scabra</i>	Common Wheat-grass	1, 2, 3, 4	Dry
<i>Bothriochloa macra</i> †	Red-leg Grass	1, 2, 3, 4	Dry
<i>Carex appressa</i>	Tall Sedge	4, 5, 6	Wet
<i>Carex breviculmis</i>	Common Grass-sedge	4, 5, 6	Wet
<i>Carex polyantha</i>	River Sedge	4, 5, 6	Wet
<i>Carex inversa</i>	Knob Sedge	3, 4, 5, 6	Wet
<i>Carex tereticaulis</i>	Poong'ort	3, 4, 5, 6	Wet
<i>Chloris truncata</i> †	Windmill Grass	All zones	Dry
<i>Deyeuxia quadriseta</i>	Reed Bent-grass	All zones	Wet
<i>Eleocharis acuta</i>	Common Spike-sedge	3, 4, 5, 6	Wet
<i>Eleocharis pusilla</i>	Small Spike-sedge	3, 4, 5, 6	Wet
<i>Microlaena stipoides</i>	Weeping Grass	All zones	Wet and Dry
<i>Poa labillardierei</i>	Common Tussock-grass	All zones	Wet
<i>Poa morrisii</i>	Soft Tussock-grass	1, 2, 3, 4	Dry
<i>Poa sieberiana</i>	Grey Tussock-grass	1, 2, 3, 4	Dry
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	All zones	Dry
<i>Rytidosperma duttonianum</i>	Brown-back Wallaby-grass	All zones	Wet
<i>Rytidosperma racemosa</i>	Slender Wallaby-grass	All zones	Dry
<i>Rytidosperma semiannulare</i>	Wetland Wallaby-grass	All zones	Wet
<i>Rytidosperma setaceum</i>	Bristly Wallaby-grass	All zones	Dry
<i>Themeda triandra</i> †	Kangaroo Grass	All zones	Dry
INDIGENOUS FORBS, SMALL SHRUBS AND PETALOID MONOCOTS			
Key genera:			
L Asphodeleaceae (formerly Liliaceae)			
F Fabaceae			
A Asteraceae			
<i>Acaena echinata</i>	Sheep's-burr	1, 2, 3, 4	Dry
<i>Acaena ovina</i>	Australian Sheep's-burr	All zones	Wet and dry
<i>Allitia cardiocarpa</i> A	Swamp Daisy	3, 4, 5, 6	Wet
<i>Allitia uliginosa</i> A	Small Swamp-daisy	3, 4, 5, 6	Wet
<i>Arthropodium fimbriatum</i> L	Nodding Chocolate-lily	1, 2, 3, 4	Dry

Species Name	Common Name	Suitable Zones	Habitat Fidelity
<i>Arthropodium milleflorum</i> L	Pale Vanilla-lily	1, 2, 3, 4	Dry
<i>Arthropodium strictum</i> L	Chocolate Lily	All zones	Dry
<i>Asperula conferta</i>	Common Woodruff	All zones	Wet and dry
<i>Astroloma humifusum</i>	Cranberry Heath	2, 3, 4	Dry
<i>Bossiaea prostrata</i> F	Creeping Bossiaea	2, 4	Dry
<i>Bulbine bulbosa</i> L	Bulbine Lily	All zones	Dry
<i>Burchardia umbellata</i> L	Milkmaids	1, 2, 3, 4	Dry
<i>Brachyscome diversifolia</i> A	Tall Daisy	1, 2, 3, 4	Wet
<i>Caesia calliantha</i> L	Blue Grass-lily	1, 2, 3, 4	Dry
<i>Calocephalus citreus</i> A	Lemon Beauty-heads	1, 2, 3, 4	Dry
<i>Calocephalus lacteus</i> A	Milky Beauty-heads	3, 4, 5, 6	Wet
<i>Calotis scabiosifolia</i> var. <i>integrifolia</i> A	Rough Burr Daisy	3, 4, 5, 6	Wet
<i>Centella cordifolia</i>	Centella	3, 4, 5, 6	Wet
<i>Chrysocephalum apiculatum</i> ssp. <i>apiculatum</i> A	Common Everlasting	All zones	Dry
<i>Chrysocephalum semipapposum</i> A	Clustered Everlasting	All zones	Dry
<i>Coronidium gunnianum</i> A	Pale Swamp Everlasting	All zones	Wet and Dry
<i>Craspedia glauca</i> A	Common Billy-buttons	All zones	Wet and Dry
<i>Craspedia paludicola</i> A	Swamp Billy-buttons	3, 4, 5, 6	Wet
<i>Craspedia variabilis</i> A	Common Billy-buttons	All zones	Dry
<i>Cullen microcephalum</i> F	Dusky Scurf-pea	1, 2	Dry
<i>Cullen tenax</i> F	Tough Scurf-pea	1, 2	Dry
<i>Cymbonotus preissianus</i> A	Austral Bear's-ear	1, 2, 3, 4	Dry
<i>Daviesia leptophylla</i> F	Slender Bitter-pea	2, 3, 4	Dry
<i>Desmodium gunnii</i> F	Slender Tick-trefoil	1, 2, 3, 4	Dry
<i>Dianella admixta</i> L	Black-anther Flax-lily	1, 2, 3, 4	Dry
<i>Dianella amoena</i> L	Matted Flax-lily	All zones	Wet and Dry
<i>Dichondra repens</i>	Kidney-weed	All zones	Wet and Dry
<i>Dillwynia cinerascens</i> F	Grey Parrot-pea	2, 4	Dry
<i>Eryngium ovinum</i>	Blue Devil	1, 2, 3, 4	Dry
<i>Eryngium vesiculosum</i>	Prickfoot	3, 4, 5, 6	Dry
<i>Geranium solanderi</i> var. <i>solanderi</i>	Austral Crane's-bill	1, 2, 3, 4	Dry
<i>Glycine clandestina</i> F	Twining Glycine	1, 2, 3, 4	Dry
<i>Glycine tabacina</i> F	Variable Glycine	1, 2, 3, 4	Dry
<i>Haloragis heterophylla</i>	Varied Raspwort	3, 4, 5, 6	Wet
<i>Hardenbergia violacea</i> F	Purple Coral-pea	2, 3, 4	Dry
<i>Hovea heterophylla</i> F	Common Hovea	2, 4	Dry
<i>Kennedia prostrata</i> F	Running Postman	2, 4	Dry
<i>Leptorhynchos squamata</i> A	Scaly Buttons	1, 2, 3, 4	Dry
<i>Leptorhynchos tenuifolius</i> A	Wiry Buttons	1, 2, 3, 4	Dry
<i>Lomandra filiformis</i> s.l.	Wattle Mat-rush	1, 2, 3, 4	Dry
<i>Lomandra nana</i>	Dwarf Mat-rush	1, 2, 3, 4	Dry
<i>Microseris walteri</i> L	Yam Daisy	1, 2, 3, 4	Dry

Species Name	Common Name	Suitable Zones	Habitat Fidelity
<i>Montia australasica</i>	White Purslane	3, 4, 5, 6	Wet
<i>Opercularia ovata</i>	Broad-leaf Stinkweed	All zones	Wet and Dry
<i>Pimelea humilis</i>	Common Rice-flower	1, 2, 3, 4	Dry
<i>Plantago gaudichaudii</i>	Narrow Plantain	1, 2, 3, 4	Dry
<i>Platylobium montanum</i> F	Hill Flat-pea	2, 3, 4	Dry
<i>Pultenaea sericea</i> F	Chaffy Bush-pea	2, 4	Dry
<i>Ranunculus lappaceus</i>	Common Buttercup	3, 4, 5, 6	Wet
<i>Senecio campylocarpus</i> A	Floodplain Fireweed	3, 4, 5, 6	Wet
<i>Senecio squarrosus</i> A	Leafy Fireweed	1, 2, 3, 4	Dry
<i>Solenogyne dominii</i> A	Smooth Solenogyne	All zones	Wet and Dry
<i>Thysanotus tuberosus</i> L	Common Fringe-lily	1, 2, 3, 4	Dry
<i>Tricoryne elatior</i> L	Yellow Rush-lily	1, 2, 3, 4	Dry
<i>Velleia paradoxa</i>	Spur Velleia	All zones	Dry
<i>Veronica gracilis</i>	Slender Speedwell	All zones	Wet and Dry
<i>Xerochrysum palustre</i> A	Swamp Everlasting	3, 4, 5, 6	Wet

Appendix 5. Seasonal works calendar

The table below provides indicative, although not strict times to carry out key site management works. Variations may arise due to local climatic conditions and other factors. For example, weed spraying should not take place if weeds are visibly stressed from frost, drought, waterlogging or other possible reasons.

Task	Cool season				Cool season-warm season transition		Early-middle warm season			Late warm season		
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Ecological burning												
Weed scorching												
Install firebreaks												
Control weed seedlings												
C3 grass control												
C4 grass control												
Woody weed control												
Spray geophytes			<i>Bulb exhaustion</i>									
Direct seeding		<i>Sow C3 grasses</i>					<i>Sow C4 grasses</i>					
Planting	<i>Plant C3 grasses and most shrubs and herbs</i>					<i>Plant C4 grasses, water heavily</i>						

NB. Green shading indicates the optimal time of action, grey indicates alternative times that may be suitable. Unshaded background indicates an unsuitable time for works.