

Lake Pleasant View/Ballogup

Environmental Property Management Plan



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2021-2023



Contents

Acknowledgements.....	3
Disclaimer.....	3
Executive summary	4
1 Introduction	5
1.1 Size and location.....	6
1.2 Climate	7
1.3 Geology	9
2 Current environmental values	9
2.1 Cultural heritage	9
2.1.1 Bush foods.....	9
2.1.2 Artefacts.....	10
2.1.3 Meeting place	10
2.2 Important native flora and fauna.....	11
2.2.1 Flora	11
2.2.2 Fauna.....	11
3 Future works and action for next three years	12
3.1 Protection and restoration of habitat.....	12
3.1.1 Disease and hygiene issues	13
3.1.2 Fire management	13
3.1.3 Zones of management	14
3.1.4 Detailed weed control and planting activities.....	15
3.2 Species lists	20
3.2 Fauna recovery activities	22
3.3.1 Western ringtail possum	23
3.3.2 Australasian Bittern.....	24
4 Priority actions and budget.....	27
5 Monitoring and evaluation	28
6 Conclusion.....	29
7 References	30
Appendix 1: Conservation species that occur within a 5km radius of Lake Pleasant View/Ballogup property	32
Appendix 2 – Species names of vascular plants recorded on Ballogup.....	35

Appendix 3: Fauna recorded at Lake Pleasant View/Ballogup AHRGAC propret	37
Appendix 4: Species lists listed by Ballogup zones for revegetation purposes	42
Appendix 5: Names and descriptions of invasive weeds and notes on management and control options	45
Appendix 6: Priority actions and budget	51
Appendix 7: <i>Phytophthora</i> Dieback Dieback Management for Remnant Vegetation: Hygiene Notes.....	55
Appendix 8: Setting up photo monitoring points	57
Appendix 9: Monitoring templates	58



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Disclaimer

Every effort has been made to ensure the accuracy of the information provided, however the author does not accept responsibility for any omissions or errors or in how this information is used subsequently by others.

Executive summary

This Environmental Property Management Plan (EPMP) aims to support Albany Heritage Reference Group Aboriginal Corporation (AHRGAC) Noongar aspirations in their efforts to restore natural values to the Lake Pleasant View/Ballogup property, in collaboration with South Coast Natural Resource Management (SCNRM). The plan is built from weed, flora and fauna surveys and a revegetation plan for the property, as well as the needs of EPBC listed and priority flora and fauna species recorded in the area.

The plan also compliments current introduced feral animal (fox, cat and rabbit) baiting and mammal fauna monitoring being undertaken on Ballogup and surrounding reserves through a collaborative effort between South Coast NRM, Department of Biodiversity, Conservation and Attractions and City of Albany. This collaborative effort is a classic example of the type of cooperation that is needed to enable landscape-scale ecological improvement and undertake recovery actions for EPBC species.

This plan links prioritised strategic weed control and revegetation activities, developed by zones of management for the period 2021-2023. A staged approach to restoration activities is taken guided by monitoring and evaluation plans that will in turn help guide the rate of progress in relation to restoration of habitat values on the Ballogup property – while protecting aboriginal artefacts and respecting cultural needs including infrastructure required for a meeting place.

The proposed process will be a collaborative and adaptive one aimed at consolidating and building on progress with the ultimate power and involvement being driven from the ground up starting with the AHRGAC members.

1 Introduction

The development of an Environmental Property Management Plan is key to the future management of the Aboriginal owned property Lake Pleasant View/Ballogup, to protect cultural heritage and EPBC values.

This Environmental Property Management Plan (EPMP) builds on studies undertaken on the Lake Pleasant View/Ballogup property this year, collaboratively with Noongar members of the Albany Heritage Reference Group Aboriginal Corporation (AHRGAC) and in collaboration with South Coast NRM (SCNRM) through their Restoring Lake Pleasant View Project. The EPMP will guide recovery actions at Lake Pleasant View property for priority flora and fauna, and species with cultural significance, with input from AHRGAC. The plan will be informed by consultation with the AHRGAC, and will provide opportunities for their involvement in future management.

Earlier studies have documented weeds and their management, vegetation and fauna surveys, a revegetation plan and species list. The fauna study was carried out by Ecologist Angela Sanders and the remaining studies were carried out by the author of this plan.

This EPMP aims to provide ecological restoration guidelines for Ballogup – the property of Noongar members of the Albany Heritage Reference Group Aboriginal Corporation (AHRGAC) to help facilitate the implementation of their vision for the property. The vision of the Noongars is: “...to take it back to being as natural as possible – has been much neglected. Has had cattle on it. Then sold to someone who mined the granite” (pers. comm. V. Gillies, February 2021). The Noongar name for the property is Ballogup which means place of the big blue breasted swamp hen.

The goals of the EPMP are to:

- Guide the immediate retention and protection of native vegetation and management of weeds during development,
- Provide detailed plans for implementation of restoration of native vegetation for the period 2021 to 2023
- Provide general principles for the long-term management of vegetation for biodiversity outcomes and asset protection.

The mission of ecological restoration is to restore a functional ecosystem of a designated type/s that can mature and evolve naturally over time in response to changing environmental conditions. That is, that the vegetation communities that are being restored be resilient enough to grow to maturity and be self-replacing or maintain adequate functionality when faced with disturbance such as fire, flood and drought. Effective establishment of an ecosystem will require sufficient species composition and abundance to allow the development of the designated vegetation community structure and to initiate ecosystem processes (Clewel et al, 2000).

Reference ecosystems that occur naturally on matching soil types, landscape positions and hydrological conditions in a local area are the basis on which targeted ecological restoration of vegetation communities are based, providing the abiotic conditions are still suitable for the reference system to establish effectively.

This report includes a description of site extent and features, identification of relevant vegetation management zones, descriptions of vegetation management plan tasks, indicative budget and timeframes for tasks, suggested monitoring and evaluation processes and annotated maps demonstrating relevant features identified in the report. All property size areas are measured on Google Earth.

1.1 Size and location

The six ha Lake Pleasant View/Ballogup property is located immediately to the north-east of the Manypeaks town site, approximately 35 km north-east of Albany. Lake Pleasant View Nature Reserve is vested in the Department of Biodiversity, Conservation and Attractions (DBCA) directly to the north of the property. The City of Albany has vesting of a nature reserve to the west of the property, and includes a cleared area which is a community waste transfer station (Figure 1). Context maps showing the location of the property in relationship with adjacent DBCA reserves (Figure 2) and Porongurup Range and Waychinicup National Parks (Figure 3). The Manypeaks area is located within the Oyster Harbour Catchment boundary – represented by the Oyster Harbour Catchment Group (OHCG). The OHCG is of relevance to work together or collaborate on land care issues and activities.

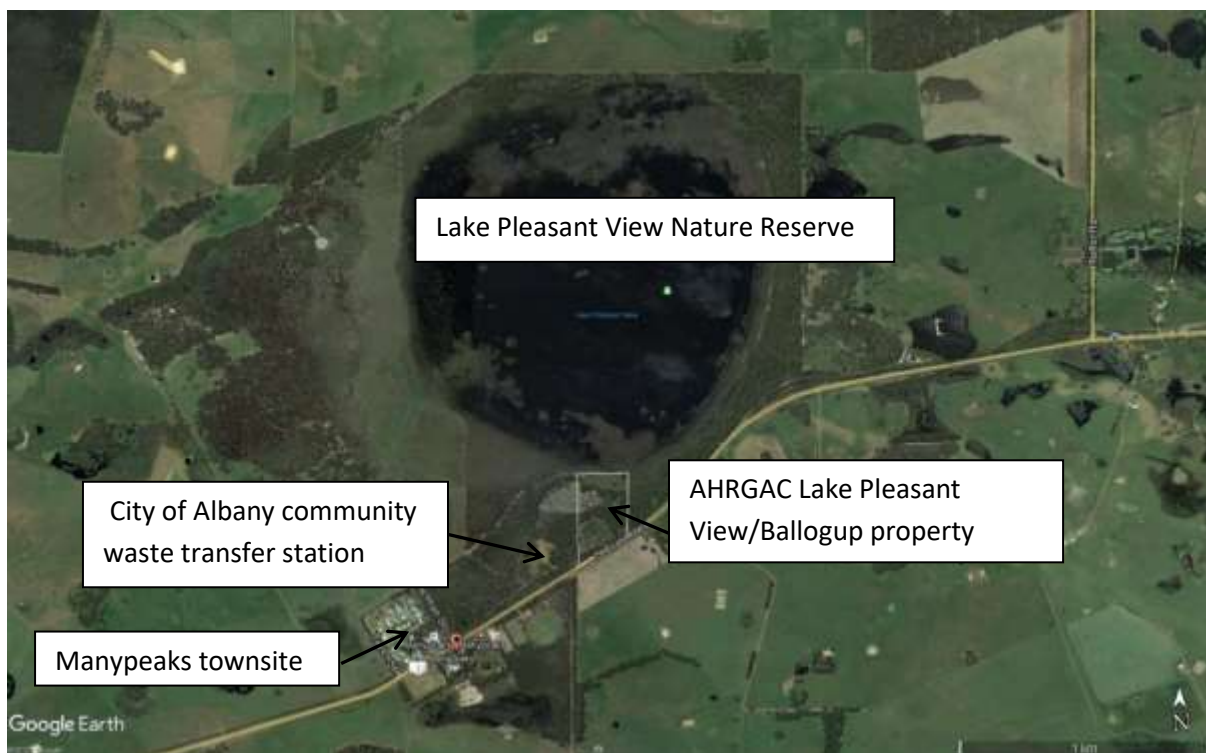


Figure 1: Context map of AHRGAC Lake Mount View/Ballogup property showing Lake Pleasant View Nature Reserve immediately to the north and City of Albany reserve immediately to the west. The cleared area denotes the area where rubbish is dumped.



Figure 2: Location of Lake Pleasant View/Ballogup property in relation to Lake Pleasant View, South and North Sister Nature Reserves

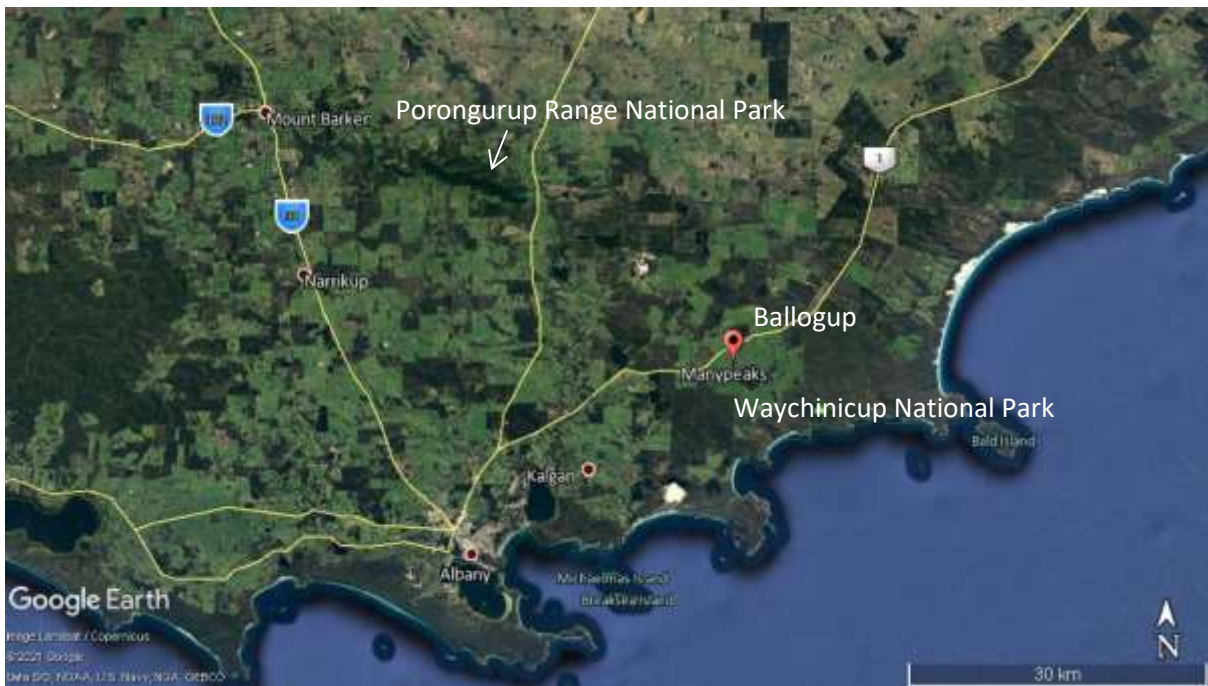


Figure 3: Context map showing location of Lake Pleasant View/Ballogup in relation to Porongurup Range and Waychiniup National Parks

1.2 Climate

The study area lies approximately midway between the 700mm and 800mm average annual rainfall isohyets (SCRIPT & RAP, 1996). The climate is Mediterranean, with generally cool and wet winters and warm, dry summers. The closest weather station with long-term climate records is Albany Airport which lies just to the north of the 800 mm annual rainfall isohyet, between the 700-800 mm annual rainfall isohyets. The Albany Airport has an annual mean rainfall of 785 mm. The wettest months are April to October. Average monthly winter rainfall is 112 mm and average monthly

summer rainfall is 24 mm. Average minimum and maximum summer temperatures are 14°C and 24°C and average winter minimum and maximum temperatures are 8°C and 16°C respectively (Bureau of Meteorology, 2021). Climate statistics are shown in Table 1.

In addition, Manypeaks climate statistics from the Department of Agriculture (DPIRD) website where records are available since 2009 show mean minimum temperature is 1.3 degrees C, mean maximum temperature is 39.4 degrees C, and mean annual rainfall is 630mm (Table 2).

Table 1: Climate statistics for Albany Airport weather station for the period 1991-2020

Source: Bureau of Meteorology 18 February 2021

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)	24.3	24.7	23.9	22.2	19.3	16.8	16.0	16.4	17.3	18.8	21.0	22.7	20.3
Mean minimum temperature (°C)	14.0	14.6	13.6	11.7	9.8	8.2	7.5	7.7	8.2	9.3	11.1	12.7	10.7
Mean rainfall (mm)	19.5	19.3	39.9	58.1	74.8	114.0	111.1	109.8	99.2	59.8	48.0	32.6	784.7
Decile 5 (median) rainfall (mm)	14.0	14.9	35.2	46.2	70.0	104.0	104.2	107.8	97.0	61.6	36.9	26.7	754.3

red = highest value blue = lowest value

Table 2: Manypeaks annual weather data 2009-June 2021

(Source: <https://weather.agric.wa.gov.au/station/MP>)

Year	Min temp °C	Max temp °C	Rain mm
2009	1.8	37.8	646.8
2010	0.7	42.3	503.4
2011	1.2	38.8	761.2
2012	1.1	40.1	563.8
2013	0.2	43.6	814.2
2014	1.7	35	433.6
2015	1.4	40.6	746.4
2016	1.3	39	829.4
2017	2.7	39.5	776.2
2018	-0.2	36.8	473
2019	-1.3	40.1	494.4
2020	0.3	40.6	676.8

1.3 Geology

The context area is underlain by the Albany-Fraser Oregon composed of Proterozoic age (1200 to 1800 million years ago) gneissic and granitic rocks. Slumping of the south coast after Antarctica began to separate from Australia about 100 million years ago, caused the sea to cover the low-lying parts of the area, when the Stirling Range and Porongurup Range were islands. Silt and spongolite (Pallinup Siltstone) was deposited under the sea and swampy sediments (Werrilup Formation) were deposited in low lying areas in the Eocene (RAP & SCRIPT, 1996). Uplift and warping associated with the down-warps of the southern edge raised the land and caused faulting and shearing of the basement rocks, the rejuvenation of drainage lines and the formation of new surfaces along the ancient river systems (Mulcahy, 1960). Laterisation occurred in the Tertiary (about 30 million years ago) (RAP & SCRIPT, 1996, p. 10).

The land surface of the context area is now a plain composed of sand and laterite that slopes gently south to the coast from the base of the Stirling Range, formed from the weathering of sediments and wind-blown sands over time. The lower parts of the plain are “broad, flat valleys containing lakes, sand dunes and erosional remnants of lateritised continental sandstone, Eocene spongolite and fossil wood”, drained at the southern edge by the headwaters of the Kalgan and Hay Rivers (Muhling et al. 1985, p. 2).

2 Current environmental values

Current environmental values are considered in terms of cultural heritage, important native flora and fauna and listed EPBC threatened species.

2.1 Cultural heritage

2.1.1 Bush foods

Aspects of the Environmental Property Management Plan (EPMP) that relate to cultural heritage include bush foods, implications of the location of cultural artefacts on revegetation techniques, and location of designated meeting site on restoration activities.

Bush foods identified growing on or adjacent to the property by Noongars while undertaking the flora survey include cummock (*Billardiera fusiformis*), kurrup (*Billardiera venusta*), and meen (*Haemodorum spicatum*) (Figures 4 to 7).



Figure 4 (left): Kurrup (with purple flower). Figure 5 (right): Cummock (not flowering at time of photograph).



Figures 6 & 7: AHRGAC Noongar elder Vernice Gillies holding meen bulb (left) and seed head spike (right).

2.1.2 Artefacts

The location of dense cultural artefact concentration in the soil sub-surface in the area between the large granite dome and the wetland located to the north of the property means that mechanical techniques involving extensive soil disturbance in this area is not permitted (Guilfoyle, 2009).

2.1.3 Meeting place

The location of a vehicle access track, parking area, meeting place and environmentally-sensitive ablutions need to be marked out at the planning stage for revegetation and restoration work to ensure the location of revegetation/restoration of native vegetation is located appropriately to enable desired cultural outcomes (Guilfoyle, 2009). For example, the patch of kikuyu that has been designated as a path to the meeting place in front of the amphitheatre where revegetation is not desired needs to be stabilised such as by paving (for example with flat rocks) to prevent soil erosion once the kikuyu has been killed off (see weeds and their management report, p. 15). Use grass selective herbicide/s for ongoing control if needed. It is always best to leave the ground covered in some form to prevent soil erosion and other weeds moving in.

2.2 Important native flora and fauna

2.2.1 Flora

No threatened or priority flora have been identified growing on the property so far. Priority species recorded on adjacent reserves. An additional vegetation survey will be carried out in spring and is expected to reveal more species as not all species could be identified to species level due to lack of flowering/fruited material when undertaking autumn survey. A list of conservation species growing nearby to the property including seven priority species and two threatened species (pers. comm. S. Barrett, DBCA email May 2021), together with their descriptions and photographs where available are attached in Appendix 1.

A total of 50 vascular plant species were identified in the autumn vegetation survey (Appendix 2), of which 32 were used in the data to determine vegetation unit/associations or types. Marri (*Corymbia calophylla*) open forest is the dominant remaining bushland growing on the property, located on all except approximately 1 ha of wet flats that occur on the northern boundary of the property and the granite outcrop. The marri open forest features coastal peppermint as a low woodland stratum on sandier soils and not on loam soils – otherwise understorey between the loam and sandier soils have many common species.

A range of different habitats occur on the granite outcrop, with plants adapted to specific niches. For example, ferns such as the forked spleenwort (*Asplenium aethiopicum*) grows in rock crevices of rocky outcrops, in niches beneath overhanging rocks, while rock fern (*Cheilathes austotenuifolia*) grows in exposed rock outcrops (Figures 8 and 9). Deeper pockets of soil on the rocky outcrop have a range of shrubs, herbs, grasses and sedges.

Based on very little remaining original vegetation, the wet flat to the north of the property suggests it was originally a yate (*Eucalyptus cornuta*)/paperbark (mixed *Melaleuca* species) flat. More extensive soil sampling is required in this area to distinguish more accurately comparisons between yate flat to the west of the property (on CoA land) and paperbark community to the east on DBCA nature reserve prior to finalising species lists for revegetation purposes in this area.

2.2.2 Fauna

A full list of fauna species observed on the Lake Pleasant View/Ballogup property is shown in Appendix 3 (taken from Sanders 2021 Fauna Assessment Interim Report). The following conservation species were recorded on the Lake Pleasant View/Ballogup property or in one of the adjacent reserves include:

Endangered species: Managi or Baudin's cockatoo (*Calyptorhynchus baudinii*) (note: Ngorlark/Ngoorlak or Carnaby's cockatoo (*Calyptorhynchus latirostris*) has been recorded in adjacent DBCA property. (Note: Boordenitj or Australasian bittern (*Botaurus poiciloptilus*) and Koomal or western ringtail possum (*Pseudocheirus occidentalis*) has been recorded in adjacent DBCA property (Bannister, 2019, 2020).

Vulnerable species: Karrak or forest red-tailed black cockatoo (*Calyptorhynchus banksii*).

Priority 5: Quernd/Querrnt or quenda (*Isoodon obesulus*) (unconfirmed sighting based on diggings that are typical of quenda) (Sanders, 2021). Additional priority taxa known to occur in Lake Pleasant

View Nature Reserve include rakali (aboriginal name) or water rat (*Hydromis chrysogaster*); little bittern (*Ixobrychus dubius*) and blue-billed duck (*Oxyura australis*) (pers. comm. S. Comer, DBCA, email June 2021).

A total of 33 bird species were recorded on the property in the autumn fauna survey.

Woodland/forests provide exceptional habitat for many bird species as they contain nesting hollows, abundant prey such as insects and spiders, and plenty of nesting sites (Sanders, 2021). Other fauna that were observed of special interest are echidna, and possibly quenda as indicated by diggings.

Two reptiles were observed on the granite rock. Granite outcrops provide many habitat components for reptiles including cracks, crevices, flat rocks, areas of soil and vegetation. Five species of frog were recorded on the property. Introduced species observed include rabbit droppings and red fox skeleton (Sanders, 2021).



Figures 8 and 9: Ferns growing in different habitat niches on granite outcrop: forked spleenwort in crevices and under overhanging rocks (left) and rock fern (right) growing on exposed rock crevices

3 Future works and action for next three years

The following works and actions are aimed at maximising restoration of biodiversity including habitat protection and restoration, and recovery actions for important flora and fauna species, including threat management such as disease, fire, weeds and pests and revegetation plans.

3.1 Protection and restoration of habitat

Zones of management designated for revegetation purposes based on mapped areas identified in vegetation survey and revegetation plan and species list reports prepared by the author with an added two zones to cover areas that require weed control with the possibility of infill planting (Figure 9). Mapping of these zones is broad and based on aerial photography and needs to be ground-truthed when undertaking on-ground works. Some areas have been mapped as being a mix of two zones where it wasn't possible to delineate exactly the differentiation between areas that have lost understorey with areas that haven't at the scale used and will need to be specified in detail when undertaking the on-ground planning stage of actual areas being targeted for work.

3.1.1 Disease and hygiene issues

Of relevance to all management zones is the threat of *Phytophthora* Dieback. No signs of this disease were observed on the property. A precautionary principle should be adopted particularly in areas where knowledge of the presence of the disease is limited. Hygiene management planning and practices should reduce the likelihood of spreading infested soil and plant material (Conservation Commission of WA, 2012).

Approximately forty percent of native plants of south Western Australia are susceptible to dieback (*Phytophthora cinnamomi*). Dieback infestation is chronic on the South Coast (from Walpole to Esperance) where very few large patches of un-infested bush remain. It is therefore critical to the health of the bushland and associated fauna to keep dieback free status where this still exists. Landowners with dieback free bush on private property have the greatest ability to protect these areas by controlling access and following hygiene protocols to prevent infection (South Coast NRM, n.d.). Dieback is easily introduced with contaminated soil and spreads in the soil by water. Hence lower-landscape areas are most susceptible.

It is important to minimize the movement of infected soil by entering the property with clean boots, machinery and equipment and to purchase plants from nurseries with Nursery Industry Accreditation Scheme Australia (NIASA) accreditation. Essentially this means come in clean and leave clean!

More detailed information about *Phytophthora* dieback management in a bushland and revegetation can be found in Appendix 6 and online at www.dieback.org.au.

3.1.2 Fire management

The role of cultural burning (small patch burns) on the property needs to be discussed and clarified with the AHRGAC members. Fire is a powerful and stressful process for the bush and needs to be used in a deeply considered way, and in context of the vision of the AHRGAC members to restore biodiversity values on the property.

From an ecological perspective, bushland species that are senescent (dying) due to old age and require hot fire to regenerate are a good sign that fire is needed. Examples of species that require fire to regenerate that were recorded on the property are coastal peppermint (*Agonis flexuosa*) which regenerates from seed held in the canopy or by resprouting from the base and yate (*Eucalyptus cornuta*) which resprouts from epicormic buds located under the bark on the trunk (Barret et al, 2009). Coastal peppermint trees on the property appear healthy and the only remaining yate tree observed on the property was burnt in the bushfire in April 2020 and is resprouting (Figure 10).

Species that require fire to regenerate, don't have long-lived seeds in the soil seed bank, and don't resprout after fire (obligate seeders from canopy-held seed in woody capsules such as oak-leaf banksia (*Banksia quercifolia*) which was possibly identified regenerating close by in Lake Pleasant View Nature Reserve adjacent to the Ballogup property and is therefore a potential target species for revegetation where conditions are appropriate)) – are particularly sensitive to inappropriate fire regimes. For these types of species, too little fire and fire too often are both threats. Regeneration needs to occur before the seed stored in the canopy of dead or senescent plants is desiccated or predated by insects and then not to burn again until mature or the species will be lost. It is

important that bushland that has been burnt is not burnt again until the slowest maturing species have reached maturity and set viable quantities of seed.

To give the bush the best chance of successful reproduction, the time between fires should be about twice as long as the time to maturity of the slowest growing seeders (Hussey & Wallace, 1993, p. 150). Timing of fire is also important. Autumn burning is recommended for most regeneration burns, especially where regrowth of coloniser species such as wattles and peas are targeted (Hussey and Wallace, 1993, p. 142). Fire should be implemented cautiously and in collaboration with neighbouring reserve managers to ensure mutual agreement on minimising risk of fire escaping from the property to neighbouring reserves while improving the viability of bush will be paramount. It is also important to manage high rabbit and kangaroo populations so they don't graze out regenerating plants.



Figure 10: Resprouting growth can be seen on this yate tree one year post-fire (burnt in April 2020) that regenerates from epicormic buds on the trunk. Too frequent fire will kill indigenous species that haven't adequately recovered from previous fire

3.1.3 Zones of management

The following zones are identified with common management strategies, as mapped (Figure 11):

- Zone 1: Wet flat to north of property requires weed control and revegetation across a broad area – currently mixed introduced grassland with emergent paperbarks, yate and *Juncus* species (approximately 1 ha)
- Zone 2: Cleared area to south of property that has been revegetated and requires infill of understorey species (approximately 0.87 ha)
- Zone 3: Degraded Marri open forest over coastal peppermint woodland (approximately 0.72 ha)
- Zone 4: Degraded Marri Open Forest (approximately 0.28 ha)
- Zone 5: Rocky outcrop matrix – pockets of soil with variable native shrub, sedge, herb and grass cover and variable weed cover. Some patches require strategic weed control with the possibility of infill planting (approximately 1 ha)
- Zone 6: Intact remnant vegetation that requires ongoing vigilance for invasive weed control (approximately 2 ha).

3.1.4 Detailed weed control and planting activities

All zones are vulnerable to invasive weeds such as bridal creeper, Sydney golden wattle and blackberry. Detail on management of these species and other weeds discussed in this report are provided in Appendix 5. The seed of both of these species is spread by birds and both have the capacity to become dominant in previously intact bushland (Zone 6). Annual and ongoing surveillance and planned multi-pronged, ongoing management of these species is required, preferably including working with neighbouring reserve managers to control stands on nearby properties at the same time.

Small stands of bridal creeper can be removed by digging out but need to ensure the entire tuberous roots are removed and continue to monitor that control has been effective. Only one individual of Sydney golden wattle was recorded, on the top of the granite outcrop. Hand removal of Sydney golden wattle while small is ideal but if not small enough, can be managed by cutting and painting or drilling with herbicide as outlined in Appendix 5.

Following is response from City of Albany Reserves Officer, Sandra Maciejewski regarding weed management at the CoA Manypeaks transfer station and reserve (email 28 May 2021):

The Manypeaks Transfer Station is not a priority area for weed control in the City's Environmental Weed Management Plan. As a result, the City has not spent a lot of time in there.

Talking to the guys we have:

- Maintained fire access tracks and access into the transfer station. This has involved some weed control.
- A prescribed burn is planned, but is not a priority at the moment given recent fires in the area.
- The actual transfer station is kept really tidy, with rubbish bins removed weekly or twice weekly, so the chance for vermin to establish is very low. Weeds are also controlled within the fenced area. The City has funds to undertake pest control at this site if it is found to be a problem. At this stage, no problem has been identified. Even birds don't seem to be a problem at this site. Any rubbish that escapes the bins is picked up too.
- African Love Grass has been sprayed and some Sydney Golden Wattle has also been controlled.

However, given there is an active community project happening in that area, the City can allocate some time to undertake additional weed control works in that reserve if this is what the project requires. The City is also happy for others to undertake weed control on this reserve, as long the City is aware of what is planned and when. Peter Bockman (0437 613 230) is the best person to liaise with on this matter.

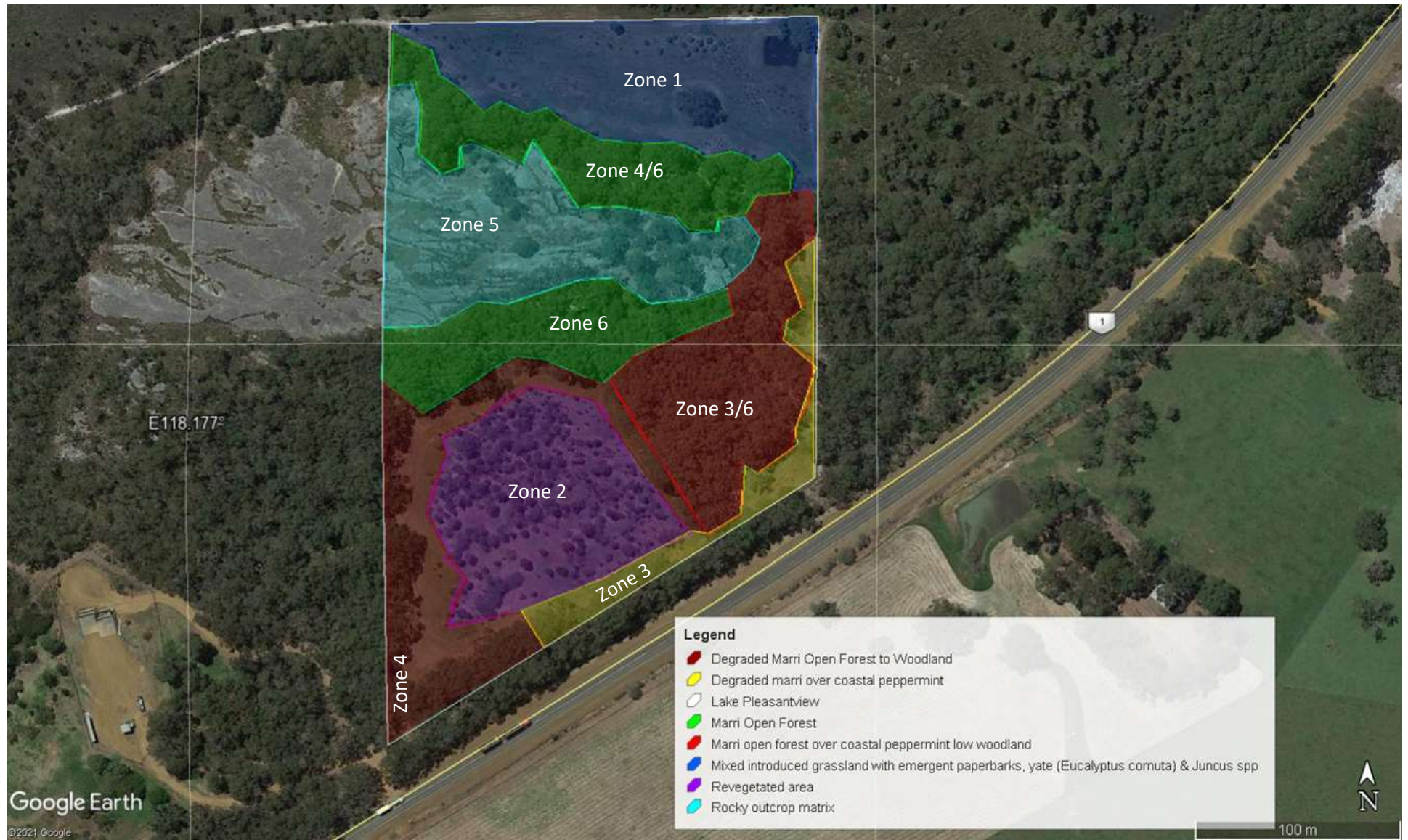


Figure 11: Vegetation map and management zones for Lake Pleasant View/Ballogup property

3.1.4.1 Zone 1: Wet flat to north of property

This area of approximately 1 ha is currently mixed introduced grassland with emergent yate, paperbarks, and sedges (*Juncus pallidus* and the weed *Juncus microcephalus*). This area requires weed control and revegetation around existing remnant vegetation (yate tree, paperbarks and *Juncus pallidus*). Weed control and revegetation strategies in this zone as shown in the weed management report with the exception of the last dot point under point 4. For more detail on weed control, please see the weeds and their management report. Detailed weed control treatments are shown

1. A high priority for management and control during summer months is the blackberry which was observed as isolated individuals in low abundance near the north-east and ENE boundaries amongst introduced grasses – predominantly sweet vernal grass. It appears that considerable effort has already been made to control this species as individuals are small and likely to be regrowth from previous blackberry control efforts. Blackberry also resprouts after fire which is also the perfect time to make extra effort to eradicate. This weed needs to be eradicated prior to undertaking revegetation of this area as disturbance triggers germination of any seeds left in the ground. After revegetation, it will be important to monitor in case there is any ongoing regeneration of blackberry.
2. Meanwhile, continue to manage other broad-leaf weeds observed in this area including inkweed, spear thistle, black berry night shade and fleabane can all be targeted with using hand sprayer to target only the weed species as much as possible.
3. A patch of the introduced rush *Juncus microcephalus* occurs within the wet flat which needs to be distinguished from the naturally occurring rush *Juncus pallidus* (pale rush or bulrush) that is also on the flat and is not a weed.

3.1.4.2 Zone 2: Cleared area to south of property that has been revegetated

Zone 2 (approximately 0.87 ha) has well established revegetation of upper- and mid-storey but lacks ground cover and low spreading and small shrubs. To mimic the original vegetation as much as possible requires infill of the missing stratum of shrubs less than 2m in height, particularly targeting low spreading species that provide cover for animals such as small mammals that are vulnerable to predation in open areas such as quenda. Weed control strategies (points 1 and 2) are adapted from the weed management report.

Tasks as follows:

1. One stand of bridal creeper was recorded in this area (shown on map in weed management plan) but cannot be sure there aren't others – after reconnaissance for others, spray annually until controlled at early flowering (August) prior to seed set.
2. In areas not able to be accessed by machinery but are open enough to enable establishment of seedlings, spot spray grasses and broad leaf weeds (including South African orchid) in spring the year before planting.
3. If another germination of weeds occurs the following autumn/early winter can be sprayed again prior to planting seedlings in weed controlled areas.
4. Hand planting will be quite an intensive operation in these areas, depending on the soil softness. If pottiputki (hand-held tree planter) does not penetrate the soil easily, the soil will

need digging in the immediate area that is being planted. Ensure seedlings are planted deep enough to allow formation of a small well around it for water to be held around the seedling. Plant in May/June once good weed control is achieved and the soil profile is moist.

5. A possible alternative or addition to hand planting seedlings would be to hand broadcast a mix of a small amount of seed such as native grasses mixed with vermiculite on ground that has been lightly dug, and rake in lightly to cover seed.
6. If target areas are large enough (possibly such as shown in Figures 2 and 3) to enable access for machinery, consider undertaking these areas at the same time as areas in Zones 3 and 4 that are also of sufficient size to enable machinery access, following the relevant tasks as set out under Zones 3 and 4.

3.1.4.3 Zones 3 and 4: Degraded Marri open forest over coastal peppermint woodland (approximately 0.72 ha) and Degraded Marri Open Forest (approximately 0.28 ha) respectively

Understorey species for both Zones 3 and 4 in surveys were very similar, except for coastal peppermint and are therefore grouped together in the species list (Appendix 3). These areas mostly have the tallest over-storey stratum still present but lack most understorey strata.

When undertaking weed control, it is important to replace weeds with desired plants to enable competition for weeds. Follow up weed control with selective herbicides that don't harm the native species may be required and ongoing monitoring is important to ensure progress is achievable.

Recommended tasks for weed control and planting are as follows:

1. Identify manageable sized target areas for weed control and revegetation in collaboration between AHRGAC members and South Coast NRM in context with available resources.
2. To maximise the area to be restored provided resources are available, it is suggested to start with the most cleared areas where there is sufficient access for machinery (Figures 12-16) such as a motor bike or small tractor with mounted boom spray and deep ripper.
3. Commence weed control the year prior to revegetation, as described in weed control methods for these areas (shown below from weed management report).
4. It is expected that follow up weed control will be required prior to planting. Planting should be undertaken as early as possible once weed control has been achieved to maximise the opportunity for plants to get established prior to the following summer.
5. Deep rip areas where weed control has been carried out and wherever access for machinery can be achieved, at approximately 1.5 m spacing to allow maximum coverage of seedlings.
6. Plant with hand-held tree planters into rip lines where possible. Seedling species being planted should be mixed up and spacing between seedlings depends on growth form of plants. Seedlings can be planted as close as 1 m apart such as for grasses and 1.5-2m apart for shrubs. The larger shrubs and small trees interspersed where missing in the existing remnant vegetation should be the smallest component of the species being planted to allow the lower storey to flourish.
7. In tight areas where there is no access to machinery, a similar process of spot spraying with relevant herbicides at the optimum time depending on the weeds being targeted, and hand planting as described under Zone 2, points 3 and 4 above would be required.

8. Where understorey is partly still present in existing remnant vegetation, ongoing monitoring is needed to determine what native species and weeds are present as a basis for developing a strategic approach – whether a grass selective herbicide such as Verdict alone will enable natural regeneration to outcompete weeds or if other weeds are also present, what other strategies might be required and whether infilling of understorey is also required (Figure 15).

Weed control methods (from weed management plan Zone 2: Partially cleared/degraded areas) are as follows:

1. Target isolated patches of buffalo grass (located at front gate) and kikuyu (e.g. on western boundary and on granite outcrop) and where possible, once control is achieved, infill with dense understorey where desired. The patch of kikuyu that has been designated as a path to the meeting place in front of the amphitheatre where revegetation is not desired should be paved with flat rocks to prevent soil erosion once the kikuyu has been killed off. Use grass selective for ongoing control if needed. It is always best to leave the ground covered in some form rather than bare to prevent soil erosion and other weeds moving in.
2. The widespread sweet vernal grass should be tackled in manageable sized patches. It should be noted that the current practice of slashing is ineffective and encourages regrowth of this perennial grass. The only way slashing could be used as a strategy would be similar to fire where regrowth is sprayed out prior to flowering. Once eradicated from an area, that patch needs to be infilled with dense understorey prior to moving on to the next patch or the grasses will be able to move straight back in. Any regrowth of sweet vernal grass into revegetated areas should be managed with grass selective herbicide (such as Verdict®520).
3. Where sweet vernal grass has infiltrated areas that still have some understorey, these can be managed with grass selective herbicide (such as Verdict®520). However, beware that this will take out native grasses also. A patch of the native weeping rice grass (*Microlaena stipoides*) was observed growing together with sweet vernal grass and next to it where the sweet vernal grass hadn't yet infiltrated or where the bush was less disturbed. Therefore it is important to be aware of what weeping rice grass looks like and not to spray at all unless sweet vernal grass is taking over. Forest rice grass (*Tetrarhena laevis*) was also recorded in the vegetation survey and is another native grass to look out for. In small infestations of co-occurrence, digging up the sweet vernal grass might be an option but need to be sure to get the entire base of the grass so that it won't reshoot.
5. Keep an eye out for the South African orchid which is a small herb that can gradually take over bare areas. Only two individuals were observed, both of which were removed with the tuberous root. As their seed is very fine, they can blow in from outside and establish. Digging prior to flowering to ensure removal of tuber is effective and manageable when only small areas are infested.

3.1.4.5 Zone 5: Granite outcrop

Weeds recorded on or near the granite outcrop include kikuyu, bridal creeper, inkweed, sweet vernal grass/Yorkshire fog or velvet grass, wild oats, Sydney golden wattle (on CoA land, close to boundary of property), and deadly night shade. Control methods for these weeds are detailed under Zones 1, 3 and 4 above, as well as in Appendix 5.

Suggested approach on Zone 5 is to prioritise invasive weed control (bridal creeper and Sydney golden wattle) annually (along with the remaining property), and then tackle restoring degraded pockets of vegetation on the outcrop when resources are available to enable a good job of weed control followed by infill planting if needed.

3.1.4.6 Zone 6: Intact remnant vegetation

Zone 6 of approximately 2 ha is basically intact remnant vegetation and may have non-invasive weeds that are now naturalised part of the bushland and don't justify control such as blow fly grass. However, these areas are susceptible to invasive weeds and require ongoing vigilance and management.

3.2 Species lists

Species lists are listed by zone (Appendix 4), from revegetation plan and species list report). The species lists include common names where known, a description of the plant form and propagation information. When determining species lists for revegetation, it is important to liaise with relevant nurseries to discuss the possibility of availability of desired species. It is recommended that where over-storey is required, that this be a minor part of the order compared to the number of under-storey species required. Ground cover and low growing species are often the most difficult to acquire. For example, *Gastrolobium sericeum* is an excellent ground cover species that grows on wet flats but doesn't provide a lot of seed. Cutting-grown seedlings might be needed. Nurseries need plenty of time to prepare for growing some species and the earlier that is practically possible to start discussing with them the better - definitely by late spring. It is also important to consider growing conditions and ensure the species that are likely to do the best are well represented in the mix. For example, rushes and sedges will be very important on the wet flat particularly as not to be mounded prior to planting and in case of a very wet summer.



Figures 12 & 13 (top, Zone 2) and 14 to 16 (middle and left bottom, Zones 3 & 4): Open areas where access for machinery for spraying and deep ripping equipment may be possible. Figure 17 (bottom right, Zone 3 as shown by the coastal peppermint to the rear) shows an area where some understorey is still present. Ongoing monitoring is needed to determine what native species and weeds are present as a basis for developing a strategic approach – whether a grass selective herbicide such as Verdict alone will enable natural regeneration to outcompete weeds or if other weeds are also present, what other strategies might be required and whether infilling of understorey is also required

3.2 Fauna recovery activities

Threats to the two EPBC threatened species known to occur in the Lake Pleasant View Reserve including the Endangered Australasian bittern and the critically endangered western ringtail possum as outlined in respective recovery plans include:

- Australasian bittern: altered hydrology due to land-use change, climate change, bushfire and inappropriate fire regimes, habitat damage and predation by introduced predators, particularly the European red fox (DBCA, 2018).
- Western ringtail possum: habitat loss and fragmentation, predation, climate change, timber harvesting, fire, competition for tree hollows, habitat tree decline, un-regulated relocation of orphaned, injured and rehabilitated western ringtail possums, disease and gaps in knowledge (WA Department of Parks and Wildlife, 2017).

South Coast NRM is undertaking rabbit baiting: in November 2020, South Coast NRM released RHDV1-K5 (calici virus K5 strain) to control rabbits at one site on the AHRGAC property and one site each in North Sister and South Sister. Free-feeding (chopped carrots or rolled oats) occurred on the 4th and 5th November, and the virus was released with feed (chopped carrots) on the 6th November. Introduced predator control (fox and feral cat) control is undertaken up to four times per year on surrounding DBCA and CoA reserves and includes a combination of baiting and trapping by DBCA.

Activities planned to restore natural ecosystems on Lake Pleasant View/Ballogup target supporting existing populations of western ringtail possums and Australasian bittern by improving habitat quality and reducing the threat of weeds, feral animals and fire coming into the adjoining reserves from the property. Actions align with Recovery Plans for Australasian bittern and Western ring-tail possum (DBCA, 2018 and DBCA, 2017) respectively. There are opportunities for collaboration between agencies and AHRGAC to provide training, casual work and involvement in surveys to aid the recovery of key EPBC species.

The wet flat (Zone 1) on the north of the property adjoins directly to the Lake Pleasant View Nature Reserve, and as discussed above is currently dominated by a range of weeds, including blackberry. By transforming this area into a much more natural ecosystem will create habitat for more beneficial species that is expected will have positive ecological spinoffs for the surrounding bushland, particularly expanding foraging habitat for the Australasian bittern.

Habitat critical to survival of western ringtail possums in the South Coast zone (between Walpole and Cheynes Beach of relevance to the Lake Pleasant View/Ballogup property include jarrah marri thicket, woodland and forest, myrtaceous heaths and shrublands and peppermint woodlands (DPAW, 2017). Suitable habitat provides “high nutrient foliage availability for food, suitable structures for protection/nesting, and canopy continuity to avoid/escape predation, and other threats (DPAW, 2017, p. 15). Long-term survival of the species requires linkages between suitable habitat and as such habitat critical to survival should not be limited to only the critical habitat as well as linkages between critical habitats (DPAW, 2017).

The diet of Western ringtail possums almost exclusively comprises the dominant or co-dominant upper and mid-storey myrtaceous plants: peppermint, marri and jarrah. Peppermint trees (*Agonis flexuosa*) have higher foliage nitrogen content relative to jarrah forest habitats, possibly explaining

the higher birth rates and higher rates of female births in peppermint woodlands (Jones *et al.* 1994b). Peppermints, jarrah and marri all occur naturally on the property in remnant vegetation and peppermint is associated with marri and jarrah on sandier sites to the east and south of the granite outcrop.

Endangered black cockatoo species (Carnaby’s, Baudin’s and forest red-tail) are known to occur in the area of the property – which also contains healthy stands of marri (*Corymbia calophylla*) and jarrah (*Eucalyptus marginata*) which are important habitat and food source for the cockatoos. Proteaceous species which also provide food for cockatoos will be included in the revegetation wherever appropriate and possible.

3.3.1 Western ringtail possum

South Coast NRM are working collaboratively with DBCA, City of Albany and Noongar volunteers to undertake fauna monitoring in woodlands/forests located in the suite of wetlands of which Lake Pleasant View Nature Reserve is a part (includes North Sister and South Sister Nature Reserves as well as CoA reserve). Western ringtail possum monitoring includes quarterly replicated transect spotlight surveys and remote cameras (Bannister, 2020). Camera and trapping results so far (Figure 18) shows high numbers of foxes and rabbits and both increasing in number between August and October. The current monitoring project commenced July 2019 and will end at end June 2023. The aim of the monitoring is to determine the effectiveness of threat mitigation on the western ringtail possum.

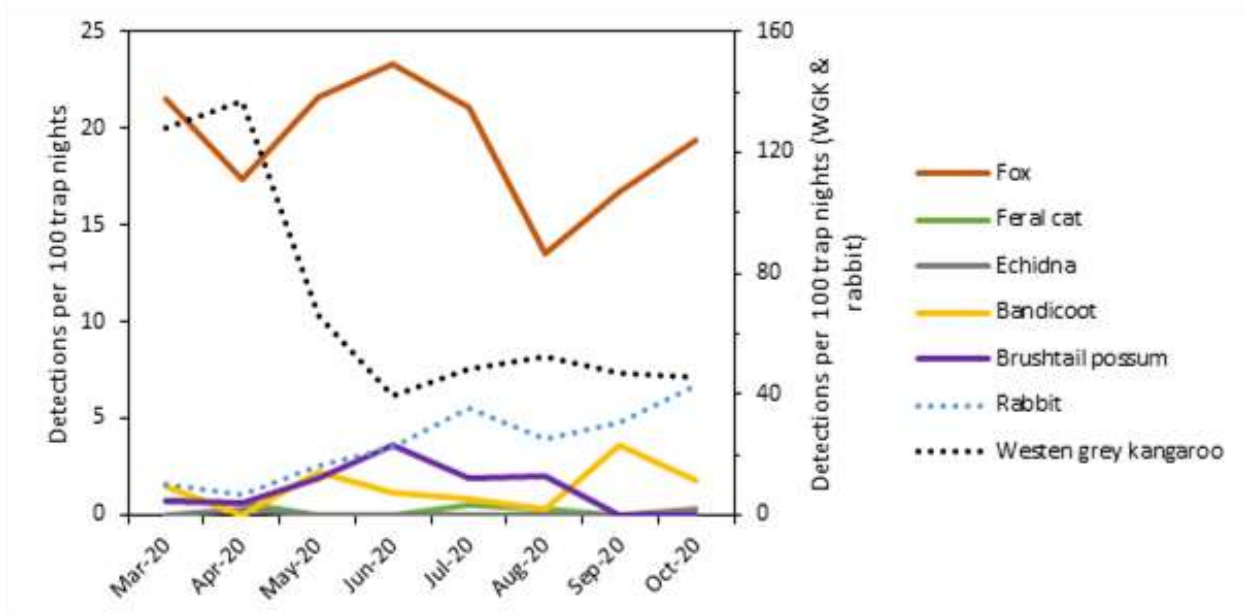


Figure 18: Quarterly fauna camera and trapping results for feral and native mammals undertaken by South Coast NRM at Lake Pleasant View/Ballogup, City of Albany and DBAC reserves including Lake Pleasant View, South Sister and North Sister reserves in 2020 (Source: H. Bannister, n.d.).

Spotlighting results undertaken in for western ringtail possum in autumn, winter and spring 2020 show that Western ringtail possums have been confirmed at all three locations surveyed. The total numbers of Western ringtail possums detected per transect (T1-5 as shown in Figure 19) over the three survey nights were as follows:

- Transect 1: 4 adults and 2 juveniles
- Transect 2: 4 adults and 2 juveniles
- Transect 3: 2 adults
- Transect 4: 5 adults and 1 juvenile
- Transect 5: 1 adult



Figure 19: The location of five spot-light transects (Source: H. Bannister, n.d.).

3.3.2 Australasian Bittern

Monitoring in the Lake Pleasant View wetland suite is coordinated through the BirdLife's WA Bittern Project in collaboration with DBCA and through the WA Australasian bittern (*A. bittern*) Recovery Team. Monitoring under their Australasian bittern Recovery Plan includes:

- Targeted *A. bittern* surveys: Annual spring listening surveys using autonomous recording units (ARU) (acoustic monitoring), annual spring wading surveys to flush individual birds and conduct habitat and breeding assessment, and camera traps deployed to gather life history information (DBCA, 2018). There are opportunities for AHRGAC members to assist with surveys.
- Permanent solar monitoring (pers. comm. S. Comer, email June 2021).
- Wetland hydrology: Continuous water level and rainfall monitoring using automated depth loggers and rain gauges currently undertaken at Lake Pleasant View, North Sister and Cheynes Swamps (Lane *et al.*, 2016b). Water depth loggers are being removed by DBCA but

data on water depth from the depth gauge may still be collected (pers. comm. V. Stokes email June 2021).

Acoustic survey recordings of A. bittern at Lake Pleasant by BirdLife Australia were carried out from 16 September 2019, through much of 2020 and 2021 (ongoing), as part of a four-year (2019-2022) contract for South Coast NRM. Recordings were generally made from 2.5 hours before sunrise until sunrise and from sunset to one hour after sunset (typical times of day that male A. bitterns call during the breeding season). For the period analysed 16 September to 30 November 2019, a single A bittern was recorded calling regularly (19 times) from early October to late November. On 30 October, three to four Australasian bittern calls were recorded but it is possible that only two of these calling birds were actually within the lake and the other calls were coming from nearby wetlands (Figure 20) (Stokes, 2020).

Analysis of acoustic recordings from 2020 is yet to be finalised, however A. bittern calls were assessed for the period 5/10/2020 to 1/1/2021 (Pickering, 2021).

The recordings from Lake Pleasant View had a single Australasian Bittern calling regularly from 15/10/2020 to 17/12/2020. On the morning of 26 October 2020, it appears that a second A. Bittern called on a few occasions. On the evening of 19 November 2020 a second A. Bittern possibly gave one call. However, these were the only dates that more than one A. Bittern was found to be calling on the files that were processed.

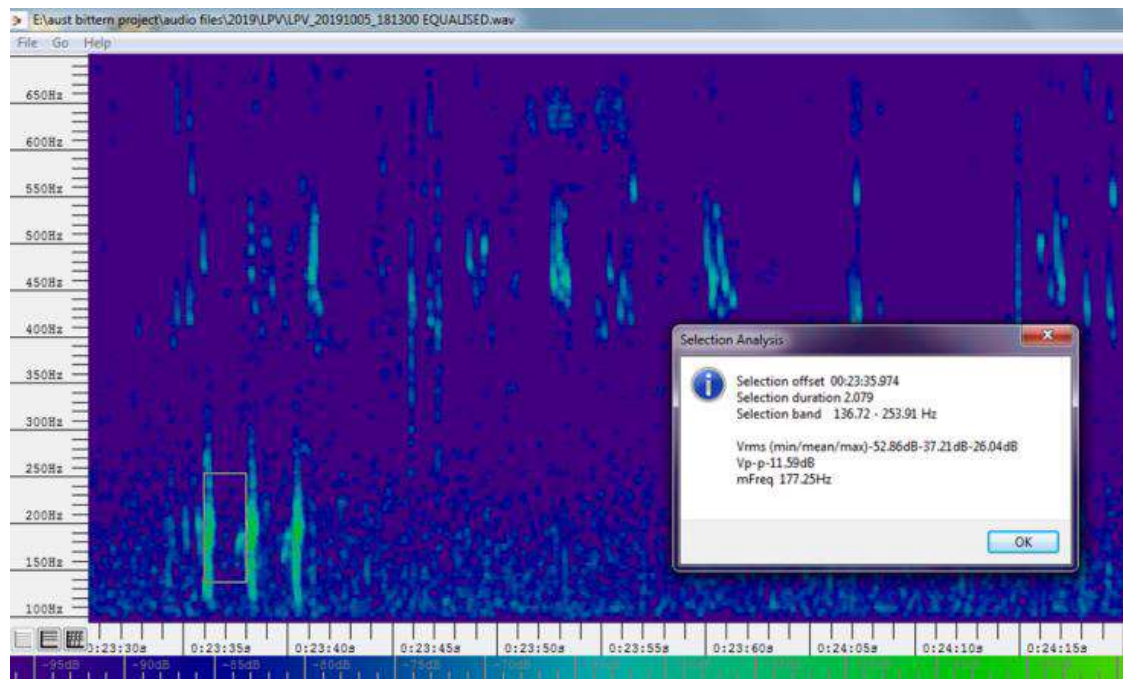


Figure 20: Call spectra of the Australasian bittern that called loudly and regularly in Lake Pleasant View (Source: Stokes, 2020)

Water levels are critical for bittern during the breeding season, influencing the availability of food to raise chicks and protection of the nest from predators. Despite the fire in Lake Pleasant View Nature Reserve in April 2020, it is known that at least one bird is still alive. Weeds in both the CoA Reserve and Lake Pleasant View Nature Reserve are managed as they are a threat to the A. bittern (pers. comm. S. Comer, DBCA, email 23 May, 2021).

Prey of *A. bittern* includes a wide range of small animals, including birds, rodents, fish, frogs, yabbies, snails, insect and spiders (BirdLife Australia, 2021). The one hectare wet flat on the north of the Lake Pleasant View/Ballogup property can provide some of these prey species. For example, lots of frogs have been seen on site (personal observation) and recorded (Sanders, 2021). *A. bittern* is generally a very wary and cryptic species, preferring to reside within the *Baumea* and fine sedge areas of such wetlands which offer protection, camouflage, vegetation for building nesting and feeding platforms, and an abundance of prey in suitably wet areas. They are also known, however, to feed out on more open areas when suitably wet and when prey is abundant. Thus, the wet flats could provide an expansion of potential feeding habitat and would be a valuable area for restoration (pers. comm. P. Barratt, BirdLife Australia 30 May, 2021).

Lake Pleasant View is listed as a globally recognised Key Biodiversity Area (KBA).

The Key Biodiversity Areas (KBAs) program is the successor and extension of BirdLife Australia's important Bird and Biodiversity Areas (IBAs). KBAs are designed to expand the IBA success story to include all biodiversity, thereby strengthening the level of advocacy for protected areas. A Global Standard for the Identification of Key Biodiversity Areas was launched by BirdLife International and ten other leading conservation NGOs in September 2016. Critically, the KBA Standard provides consistency between areas across the globe, to assist governments meeting their conservation obligations under various international treaties (BirdLife Australia website: <https://birdlife.org.au/projects/KBA>).

Lake Pleasant View does not currently have a KBA Guardian overseeing monitoring – or Health Checks - for the site. The concept of appointing KBA Guardians for Lake Pleasant View where volunteers do regular monitoring and reporting of birdcalls or sightings to BirdLife Australia is flagged as something members of the AHRGAC might be interested in finding out more about – BirdLife Australia may be able to run a workshop with the group if interested.

4 Priority actions and budget

A summary of priority recovery actions and indicative costs for the next three years are shown in Table 3. Details on weed control and revegetation activities for each zone are detailed under 3.1.3. A detailed budget is shown in Appendix 6 (boot cleaning station not included in detailed budget).

Table 3: Summary of priority actions and approximate cost by zone for 2021-2023

Year	Zone	Activities	Overall approx. cost
2021	At front gate	Set up boot cleaning station at entrance to property similar to those used by DBCA at tourist attractions. Consider including signage at gate for biosecurity	\$200
2021-2023	All zones	Reconnaissance for Bridal creeper & Sydney golden wattle & control	\$2400
2021 and 2022	1	Undertake weed control in 2021 and 2022 and planting in spring 2022. Includes burning grass in Zone 1 in collaboration with neighbouring reserve managers Order seedlings for 2022 by spring 2021. Prior to ordering seedlings, undertake soil sampling across flat to determine variation in soil types and matching vegetation to neighbouring reserves so that plants such as <i>Banksia littoralis</i> that prefer sand can be planted in sandier areas. Once area of each is determined, species and seedling numbers can be determined. Check signs of rabbit population size and undertake baiting if indicated (not included in budget ?South Coast NRM cover this already).	\$10600
2022	1,2,3 & 4 (?more open areas only)	Review progress of 2022 planting (Zone 1) and if progressing well and consolidation of planting not needed in 2023, undertake strategic weed control of more open areas (Zone 2, 3 & 4) that have access to machinery, order understorey seedlings in spring for planting following year. If have resources available consider also undertaking small patches of hand (knapsack) weed control and hand planting where no access to machinery in Zone 2 and possibly Zone 5 (rocky outcrop). Order seedlings accordingly by late spring.	\$3800
2023	Zones 2,3 4 ?2 & 5	Follow up weed control if needed and deep rip and plant seedlings when good soil moisture. Plant seedlings in rip lines (Zones 2, 3 & 4) and spot sprayed areas if go ahead as determined from above (Zone 2 & 5)	\$6000 (includes additional \$200 for 2023 CPI)
2022-2023	All zones	Monitor seedling survival (late spring/early summer & autumn) from plantings and determine needs for revegetation/infill plantings and fauna survey (spring only?).	\$8400
2023	All zones	Continue with rabbit baiting if needed, apply for funding to continue with restoration activities including monitoring and pest control South Coast NRM in-house with DPIRD support?	
2023	All zones	Review EPMP and make suggestions for priority actions over the next five years	\$8000

5 Monitoring and evaluation

The very minimum of monitoring that needs to be undertaken is to check the success of work that is being undertaken to achieve the vision. It is vital that restoration activities are monitored at all stages as the program progresses, and management adapted accordingly to ensure the best results. A proposed monitoring regime that covers all aspects of the restoration process is provided in Table 4. Templates for setting up photo monitoring points and seedling survival data are attached in Appendices 7 and 8 respectively.

Table 4: Proposed monitoring regime

Restoration activity	Monitoring & evaluation processes	Evaluation tools
Weed control	Monitor progress of control of invasive weeds that move into intact bushland such as bridal creeper and Sydney golden wattle	Work collaboratively with relevant adjacent reserve officers to monitor and manage weeds together
	Ensure spraying is undertaken at optimum time to align with conditions and stage of growth of target weeds relevant control methods are enacted at optimum time to align with conditions and growth stage of target weeds – prior to setting seed (i.e. by early flowering (some plants flower for long periods and will have mature seed while still flowering. if too late will run the risk of killing out the competition and end up with a pure stand of the weed!)	Set up photo monitoring points with GPS coordinates at a few key points to show target area and activity in each zone and take before and after photos
	Check that spraying has been effective on target weeds and if not determine why not and adapt accordingly	Review management plan
Pest control	Monitor rabbit and kangaroo activity to ensure survival of seedlings. If not, take action to reduce numbers prior to planting.	Visual of rabbit diggings and sightings of rabbits in spring prior to ordering seedlings
	Monitor effectiveness of South Coast NRM & DBCA pest controls being undertaken until 2023 on native mammals and Australasian bittern on adjacent reserves. Collaborate with DBCA and CoA regarding ongoing feral animal control.	Transect data being collected by South Coast NRM, DBCA/BirdLife Australia Australasian bittern acoustic monitoring data
Revegetation	Ensure adequate weed control and suitable soil conditions (not too wet or dry) prior to undertaking planting	Visual -check soil moisture and effectiveness of weed control
	Undertake and record seedling survival counts e.g. 3 x 100 m transects/site in late spring/early summer and following autumn, record any obvious reason for failure or success and adapt activities accordingly	Seedling survival data recording templates; Photo monitoring points set up as per second point under weed control.
Fauna	Proposed ongoing monitoring of BirdLife of Australasian Bittern on DBCA reserves and SCNRM surveys of Western ringtail possum proposed for 2022 and 2023. Annual spring fauna survey 2022 & 2023 as undertaken in 2021 on Ballogup. If continued in future years, can use results to help inform progress in improving habitat values on the property. Could also target quenda as an indicator species of establishment of dense understorey. Consider involvement in Great Cocky Count annually.	Observe trends of species diversity and compare with results from South Coast NRM & DBCA data trends (see pest control section).

6 Conclusion

This Environmental Property Management Plan proposes activities to support Albany Heritage Reference Group Aboriginal Corporation Noongar aspirations in collaboration with South Coast NRM in their efforts to restore natural values to the Lake Pleasant View/Ballogup property. The plan incorporates detailed pest and weed management, revegetation priority activities and budgets and proposes a monitoring regime to track progress towards achieving the vision of members of the AHRGAC.

An all-out effort is proposed to achieve as much as possible with existing funding for the three years to 2023, while protecting aboriginal artefacts and respecting cultural needs including infrastructure required for a meeting place. The proposed process will be a collaborative and adaptive one aimed at consolidating and building on progress with the ultimate power and involvement being driven from the ground up starting with the AHRGAC members.

A possible proposed indicator of success is signs that quenda numbers are increasing. At present there are only what appear to be diggings of quenda but no confirmed sightings on the property. A key focus of this plan is to establish dense understorey of native habitat which favours quenda. Hence the idea that increasing quenda numbers over time associated with increasing dense understorey could be an exciting aspiration to work towards. Quenda are also considered to be ecological engineers because of their copious diggings leading to improved water and nutrient cycling as well as spreading around beneficial fungal spores!

Other indicators being recorded include the Western ringtail possum and Australasian bittern, and that further spread of priority weed species has been prevented.

The ongoing collaborative effort with adjacent reserve managers on threat management, together with improving habitat for critical weight range native mammals (35 g-5.5 kg) is a sound basis from which to build more resilient natural ecosystems in the area.

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Appendix 1: Conservation species that occur within a 5km radius of Lake Pleasant View/Ballogup property

Conservation species are species that are classified as threatened, extinct and specially protected (fauna and flora) which have been adequately searched for and deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. Priority species are possibly threatened species that do not meet survey criteria, or are otherwise data deficient, or require regular monitoring are added to the Priority Flora Lists (*Conservation codes for Western Australian flora and fauna*, DBCA, 2019). Definitions of Priority species classifications are shown in Table 1.

Species names of conservation flora that are currently known to occur within 5km radius of Lake Pleasant View/Ballogup were provided by DBCA Officer Sarah Barrett, Threatened Flora, Albany District. *Acacia declinata* (P4) is also known to occur in adjacent reserve/s (pers. comm. S. Comer, email June 2021) (Table 2).

Table 1: Priority species classification definitions (Source: DBCA, 2019)

Note: Priority species 1 to 3 may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

Classification	Definition
Priority 1: Poorly-known species	Species that are known from one or a few locations which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation where they are at risk of habitat destruction or degradation.
Priority 2: Poorly known species	Species that are known from one or a few locations, some of which are on lands managed primarily for nature conservation.
Priority 3: Poorly known species	Species that are known from one or a few locations, and the species does not appear to be under imminent threat.
Priority 4: Rare, Near Threatened, and other species in need of monitoring	<ul style="list-style-type: none"> (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list or threatened species during the past five years for reasons other than taxonomy.

Table 2: Species name and common name (where known), description and habitat where known
 (Source: DBCA Florabase website May 2021 available at: <https://florabase.dpaw.wa.gov.au>
 P=priority, T=threatened

Botanical & common name & conservation status	Description & habitat
Acacia declinata P4	Dense, intricately branched, prostrate, pungent shrub, 0-2-0.4 m high. Flowers yellow, Aug to Sept. Loamy or sandy clay.
Drosera fimbriata P4 (Manypeaks sundew)	Erect tuberous perennial herb, 0.05-0.15 m high. Flowers white, Sept to Oct. White sand, granite
Gonocarpus trichostachyus P3	Erect to spreading perennial herb, 0.05-0.17 m high. Flowers red-purple, Sept to Oct. Sandy soils.
Lasiopetalum sp. Denmark P3	Shrub, stems hairy. Flowers (calyx) pink, Aug to Oct.
Stylidium gloeophyllum P4	Rosetted perennial herb 0.13-0.47 m high, leaves tufted, 1.5-7 cm long, 2-12 mm wide. Flowers orange/yellow, Oct-Dec. Sandy clay loam, granite. Winter-wet depressions or fringing outcrops.
Rumex drummondii P4	Erect perennial herb, 0.6-0.9 m high. Winter-wet disturbed sites
Schoenus sp grey rhizome P1	Grass-like or herb (sedge), 0.06-0.08 m high. Sandy clay, sand.
Banksia brownii T (feather-leaved banksia)	Bushy, non-lignotuberous shrub or small tree, 1-6 m high. Flowers cream & brown/orange-red, Mar to Jul. Sand over laterite, gravel, loam over granite. In gullies.
Isopogon uncinus T	Tufted spreading or prostrate, non-lignotuberous shrub, 0.05-0.4 m high. Flowers yellow/cream, Oct to Nov. Loam or sand on granite, peaty sand. Swmpy depressions, hillslopes.

Photos of conservation species sourced from Florabase website <https://florabase.dpaw.wa.gov.au>



Isopogon uncinatus

Photos: J.A. Cochrane & R. Smith



Stylidium gloeophyllum



Photos: J. Wege



Drosera fimbriata

Photo: E. Hickman

Appendix 2 – Species names of vascular plants recorded on Ballogup

Adiantaceae

Adiantum sp.

Apiaceae

Xanthosia rotundifolia

Araliaceae

Trachymene pilosa

Asparagaceae

**Asparagus asparagoides*

Lomandra pauciflora

Aspleniaceae

Asplenium aethiopicum

Asteraceae

**Cirsium vulgare*

**Erigeron bonariensis*

**Hypochaeris* sp.

Cyperaceae

Lepidosperma ?angustatum

**Juncus microcephalus*

Juncus pallidus

Dennstaedtiaceae

Pteridium esculentum

Ericaceae

Leucopogon obovatus ssp. *revolutus*

Leucopogon verticillatus

Styphelia propinqua

Styphelia epacridis

Fabaceae

**Acacia longifolia*

Acacia myrtifolia

Acacia saligna

Bossiaea linophylla

Daviesia preissii

Hardenbergia comptoniana

Hovea chorizemifolia

Hovea elliptica

Kennedia prostrata

Geraniaceae

Pelargonium sp.

Haemodoraceae

Haemodorum spicatum

Hemerocallidaceae

Agrostocrinum hirsutum

Dianella revoluta

Hemerocallidaceae (cont.)

Stypantra glauca

Patersonia occidentalis

Lauraceae

Casytha glabella

Malvaceae

?*Guichenotia ledifolium*

?*Thomasia solanacea*

Myrtaceae

Agonis flexuosa

Calytrix hirta

Eucalyptus marginata

Melaleuca cuticularis

Melaleuca raphiophylla

Melaleuca preissiana

Taxandria theiformis

Proteaceae

Hakea oleifolia

Goodeniaceae

Dampiera alata

Orchidaceae

**Disa bracteata*

Microtis media

Passifloraceae

**Passiflora tarminiana*

Phytolaccaceae

**Phytolacca octandra*

Pittosporaceae

Billardiera fusiformis

Billardiera venusta

Poaceae

**Anthoxanthum odoratum*

**Avena barbata*

**Cenchrus clandestinus*

**Holcus lanatus*

**Stenotaphrum secundatum*

Microlaena stipoides

Poa porphyroides

Tetrarrhena laevis

Polygonaceae

Muelenbeckia adpressa

Pteridaceae

Cheilanthes austrotenuifolia

Appendix 2 – species names (cont.)

Ranunculaceae

Clematis pubescens

Restionaceae

Desmocladus flexuosus

Restionaceae (cont.)

Tetraria sp. Jarrah Forest

Rosaceae

**Rubus ulmifolius*

Rubiaceae

Opercularia hispidula

Solanaceae

**Solanum nigrum*

Appendix 3: Fauna recorded at Lake Pleasant View/Ballogup AHRGAC property

BIRDS							
Common Name	Genus	Species	Noongar Name	Cons status	Recorded April 2021	DBCAs records	ALA*
Brown Quail	<i>Coturnix</i>	<i>Ypsilophora</i>	Murit			1	1
Stubble Quail	<i>Coturnix</i>	<i>Pectoralis</i>	Baraberry				1
Little Eagle	<i>Hieraaetus</i>	<i>Morphnoides</i>				1	1
Wedge-tailed Eagle	<i>Aquila</i>	<i>Audax</i>	Wartch		1	1	1
Brown Goshawk	<i>Accipiter</i>	<i>Fasciatus</i>	Carakine			1	1
Swamp Harrier	<i>Circus</i>	<i>Approximans</i>	Dil-yurdy			1	1
Spotted Harrier	<i>Circus</i>	<i>Assimilis</i>				1	
Whistling Kite	<i>Haliastur</i>	<i>Sphenurus</i>	Mar-arl			1	1
Australian Spotted Crake	<i>Porzana</i>	<i>Fluminea</i>					1
Spotless Crake	<i>Porzana</i>	<i>Tabuensis</i>	Warraja			1	1
Baillon's Crake	<i>Porzana</i>	<i>Pusilla</i>				1	
Painted Button-quail	<i>Turnix</i>	<i>Varius</i>	Murotang			1	
Common Bronzewing	<i>Phaps</i>	<i>Chalcoptera</i>	Moyitj		1	1	1
Brush Bronzewing	<i>Phaps</i>	<i>Elegans</i>	Oo-da			1	1
Crested Pigeon	<i>Ocyphaps</i>	<i>Lophotes</i>	Gnambain			1	1
Shining Bronze Cuckoo	<i>Chrysococcyx</i>	<i>Lucidus</i>	Djuritch				1
Fan-tailed Cuckoo	<i>Cacomantis</i>	<i>Flabelliformis</i>	Woor			1	
Barn Owl	<i>Tyto</i>	<i>Alba</i>	Binar				1
Australian Owlet-nightjar	<i>Aegotheles</i>	<i>Cristatus</i>	Kukubert		1	1	1
Laughing Kookaburra	<i>Dacelo</i>	<i>Novaeguineae</i>	Gwarbeet		1	1	1
Sacred Kingfisher	<i>Todiramphus</i>	<i>Sanctus</i>	Kanjinnak			1	1
Australian Kestrel	<i>Falco</i>	<i>Cenchroides</i>	Mar-tiet			1	1

Common Name	Genus	Species	Noongar Name	Cons status	Recorded April 2021	DBCA records	ALA*
Australian Hobby	<i>Falco</i>	<i>Longipennis</i>	Wow-oo			1	1
Peregrine Falcon	<i>Falco</i>	<i>Peregrinus</i>		S		1	
Brown Falcon	<i>Falco</i>	<i>Berigora</i>	Wal-letch			1	1
Carnaby's Cockatoo	<i>Calyptorhynchus</i>	<i>Latirostris</i>	Ngoolark/Ngoorlak	EN		1	
Baudin's Cockatoo	<i>Calyptorhynchus</i>	<i>Baudinii</i>	Managi	EN	1	1	
Forest Red-tailed Black Cockatoo	<i>Calyptorhynchus</i>	<i>Banksia</i>	Karrak	VU	1	1	
Galah	<i>Cacatua</i>	<i>Roseicapilla</i>	Djakal-ngakal				1
Purple-crowned Lorikeet	<i>Parvipsitta</i>	<i>Porphyrocephala</i>	Kowar				1
Red-capped Parrot	<i>Platyercus</i>	<i>Spurius</i>	Dyarrylbardang		1		1
Australian Ringneck	<i>Platyercus</i>	<i>Zonarius</i>	Darlmoorluk		1		1
Western Rosella	<i>Platyercus</i>	<i>Icterotis</i>				1	1
Regent Parrot	<i>Polytelis</i>	<i>Anthopeplus</i>				1	
Elegant Parrot	<i>Neophema</i>	<i>Elegans</i>	Cateri		1	1	1
Splendid Fairy-wren	<i>Malurus</i>	<i>Splendens</i>				1	1
Red-winged Fairy-wren	<i>Malurus</i>	<i>Elegans</i>	<i>Deldilla</i>		1	1	1
Southern Emu Wren	<i>Stipiturus</i>	<i>Malachurus</i>				1	1
Tawny-crowned Honeyeater	<i>Glyciphila</i>	<i>Melanops</i>				1	1
Western Spinebill	<i>Acanthorhynchus</i>	<i>Superciliosus</i>	Buljit		1	1	1
Brown Honeyeater	<i>Lichmera</i>	<i>Indistincta</i>	Djindjoko		1	1	1
New Holland Honeyeater	<i>Phylidonyris</i>	<i>Novaehollandiae</i>	Bandin		1		1
Brown-headed Honeyeater	<i>Melithreptus</i>	<i>Brevirostris</i>					1
Western White-naped Honeyeater	<i>Melithreptus</i>	<i>Chloropsis</i>	Bun-geen		1		1
Red Wattlebird	<i>Anthochaera</i>	<i>Carunculata</i>	Dongrruck		1	1	1
Yellow-throated Miner	<i>Manorina</i>	<i>Flavigula</i>	Bill-your-ga			1	
Striated Pardalote	<i>Pardalotus</i>	<i>Striatus</i>	Bilyabiet		1	1	1
White-browed Scrubwren	<i>Sericornis</i>	<i>Frontalis</i>	Warrylbardang		1	1	1

Common Name	Genus	Species	Noongar Name	Cons status	Recorded April 2021	DBCA records	ALA*
Western Gerygone	<i>Gerygone</i>	<i>Fusca</i>			1	1	1
Inland Thornbill	<i>Acanthiza</i>	<i>Apicalis</i>	Djoolbedjoolbong		1	1	1
Western Thornbill	<i>Acanthiza</i>	<i>Inornata</i>				1	
Yellow-rumped Thornbill	<i>Acanthiza</i>	<i>Chrysorrhoa</i>	Djidbot		1	1	1
Grey Butcherbird	<i>Cracticus</i>	<i>Torquatus</i>			1	1	1
Australian Magpie	<i>Cracticus</i>	<i>Tibicen</i>	Coolbardie		1	1	1
Grey Currawong	<i>Strepera</i>	<i>Versicolor</i>				1	
Black-faced Cuckoo-shrike	<i>Coracina</i>	<i>Novaehollandiae</i>			1	1	1
Varied Sittella	<i>Daphoenositta</i>	<i>Chrysoptera</i>				1	
Western Golden Whistler	<i>Pachycephala</i>	<i>Occidentalis</i>			1		1
Rufous Whistler	<i>Pachycephala</i>	<i>Rufiventris</i>				1	1
Grey Shrike-thrush	<i>Colluricincla</i>	<i>Harmonica</i>	Koodelong		1	1	1
Willie Wagtail	<i>Rhipidura</i>	<i>Leucophrys</i>	Djitiidjiti		1	1	1
Grey Fantail	<i>Rhipidura</i>	<i>albiscapa</i>			1	1	1
Magpie-lark	<i>Grallina</i>	<i>cyanoleuca</i>			1	1	1
Restless Flycatcher	<i>Myiagra</i>	<i>inquieta</i>				1	1
Australian Raven	<i>Corvus</i>	<i>coronoides</i>	Wardong		1	1	1
White-breasted Robin	<i>Eopsaltria</i>	<i>georgiana</i>					1
Scarlet Robin	<i>Petroica</i>	<i>boodang</i>			1		
Welcome Swallow	<i>Hirundo</i>	<i>neoxena</i>				1	1
Tree Martin	<i>Petrochelidon</i>	<i>nigricans</i>			1		1
Australian Reed Warbler	<i>Acrocephalus</i>	<i>australis</i>				1	1
Little Grassbird	<i>Megalurus</i>	<i>gramineus</i>				1	1
Silveryeye	<i>Zosterops</i>	<i>lateralis</i>			1	1	1
Red-eared Firetail	<i>Stagonopleura</i>	<i>oculata</i>			1	1	
		Totals			33	58	58

MAMMALS

Common Name	Genus	Species	Noongar Name	Conservation Status	Recorded April 2021	DBCA records	ALA* records
Short-beaked Echidna	<i>Tachyglossus</i>	<i>aculeatus</i>	Nyingarn		1		
Yellow-footed Antechinus, Mardo	<i>Antechinus</i>	<i>flavipes</i>				1	1
Quenda	<i>Isoodon</i>	<i>obesulus</i>		P5	?		
Western Grey Kangaroo	<i>Macropus</i>	<i>fuliginosus</i>	Yonga		1		
Rabbit	<i>Oryctolagus</i>	<i>cuniculus</i>		Naturalised Exotic	1		
Red Fox	<i>Vulpes</i>	<i>vulpes</i>		Naturalised Exotic	1		
		Totals			4	1	1

REPTILES

Common Name	Genus	Species	Conservation Status	Recorded April 2021	DBCA records	ALA* records
Marbled Gecko	<i>Christinus</i>	<i>marmoratus</i>			1	
	<i>Acritoscincus</i>	<i>trilineatus</i>			1	
	<i>Ctenotus</i>	<i>labillardieri</i>			1	1
King's Skink	<i>Egernia</i>	<i>kingii</i>		1		
	<i>Hemiergis</i>	<i>peronii</i>			1	1
Carpet Snake	<i>Morelia</i>	<i>spilota</i>	S		1	
Crowned Snake	<i>Elapognathus</i>	<i>coronatus</i>			1	
Tiger Snake	<i>Notechis</i>	<i>scutatus</i>		1	1	
		Totals		2	7	2

* Atlas of Living Australia

FROGS

Common name	Genus	Species	Recorded during survey	DBCA records	ALA records
Slender Tree Frog	<i>Litoria</i>	<i>adelaidensis</i>	1	1	1
Motorbike Frog	<i>Litoria</i>	<i>moorei</i>	1	1	1
Moaning Frog	<i>Heleioporus</i>	<i>eyrei</i>		1	
Western Banjo Frog	<i>Limnodynastes</i>	<i>dorsalis</i>		1	1
Quacking Frog	<i>Crinia</i>	<i>georgiana</i>		1	
Clicking Frog	<i>Crinia</i>	<i>glauerti</i>	1	1	1
Bleating Froglet	<i>Crinia</i>	<i>pseudinsignifera</i>	1	1	1
South Coast Froglet	<i>Crinia</i>	<i>subinsignifera</i>	1	1	1
Crawling Toadlet	<i>Pseudophryne</i>	<i>guentheri</i>		1	1
		Totals	5	9	7

Appendix 4: Species lists listed by Ballogup zones for revegetation purposes

Species listed by zones as described in revegetation plan. All species will need to be negotiated with nursery/ies.			
Common names are provided where known			
To assist, the following abbreviation definitions under the propagation heading are provided to the best knowledge of the author:			
E= Species easily grown from common species that produce lots of seed			
S=species that don't produce a lot of seed and not as easy to grow			
A=Expected to be able to be grown from seed but availability of seed unknown			
D=may require to be grown from cutting or division available as tubestock			
U=Unknown whether seed is available or if able to be propagated at all - need to negotiate with nursery or contact specialist nursery/ies			
Zone 1: Yate flat area ~1 ha seedlings only ~2 x 4 m spacings = 1250 seedlings available in 64 cell trays (proposed 2022 planting) on peaty sand to loam prone to waterlogging.			
Botanical name	Common name	Description	Propagation
<i>Acacia drummondii</i> ssp. <i>elegans</i>	Drummond's wattle	small shrub	E
<i>Acacia myrtifolia</i>		medium shrub	E
<i>Acacia saligna</i>	golden wreath wattle	medium shrub	E
<i>Astartea scoparia</i>		small shrub	A
<i>Banksia littoralis</i>	swamp banksia	small tree	S
<i>Banksia quercifolia</i>	oak-leaved banksia	medium shrub	S
<i>Baumea vaginalis</i>	sheath twig rush	rhizomatous rush grown by rhizome division	D
<i>Beaufortia sparsa</i>	swamp bottlebrush	medium shrub	E
<i>Billardiera fusiformis</i>	kummack/bluebell	twining small to medium shrub	E
<i>Billardiera venusta</i>	kurrup	twining small shrub	A
<i>Boronia spathulata</i>		small shrub	D
<i>Callistachys lanceolata</i>	wannich	tall shrub	E
<i>Callistemon glaucus</i>	Albany bottlebrush	medium shrub	E
<i>Centella asiatica</i>	arthritis herb or pennywort	prostrate fleshy herb	D
<i>Daviesia preissii</i>		low shrub	A
<i>Eucalyptus cornuta</i>	yate	medium tree - need to check re permission from elders to plant a few	E
<i>Evandra aristata</i>		tufted perennial sedge	U
<i>Gastrolobium sericeum</i>		prostrate shrub with yellow pea flowers	D
<i>Haemodorum spicatum</i>	Mearn/blood root	upright herb	U
<i>Juncus pallidus</i>	pale rush, bullrush	tall clumping rush	E
<i>Melaleuca densa</i>		Medium shrub	E
<i>Melaleuca cuticularis</i>	salt water paperbark	small tree	E
<i>Melaleuca lateritia</i>	robin red-breast bush	medium shrub	E
<i>Melaleuca preissiana</i>	moonah	small tree	E
<i>Melaleuca raphiophylla</i>	fresh water paperbark	small tree	E
<i>Melaleuca thymoides</i>		small to medium shrub	E
<i>Paraserianthes lophantha</i>	albizia	small short lived tree	E
<i>Patersonia occidentalis</i>	flag iris	perennial herb	A
<i>Platysace compressa</i>	tapeworm plant	small shrub	A, U
<i>Poa poiformis</i>	Coastal tussock grass	clumping perennial grass	A
<i>Samolus junceus</i>		erect perennial rhizomatous sedge-like herb	A, ?D
<i>Taxandria linearifolia</i>		tall shrub	E
<i>Taxandria parviceps</i>	tea tree	medium shrub	E
<i>Viminaria juncea</i>	swish bush	spindly medium shrub	E

Species listed by zones as described in revegetation plan. All species will need to be negotiated with nursery/ies.			
Common names are provided where known			
To assist, the following abbreviation definitions under the propagation heading are provided to the best knowledge of the author:			
E= Species easily grown from common species that produce lots of seed			
S=species that don't produce a lot of seed and not as easy to grow			
A=Expected to be able to be grown from seed but availability of seed unknown			
D=may require to be grown from cutting or division available as tubestock			
U=Unknown whether seed is available or if able to be propagated at all - need to negotiate with nursery or contact specialist nursery/ies			
Zone 2: Infill planting of low shrubs and ground covers and other diverse species into revegetated area south of granite outcrop (proposed 2023 planting)			
Botanical name	Common name	Description	Propagation
<i>Acacia drummondii</i> ssp. <i>elegans</i>	Drummond's wattle	small shrub	E
<i>Acacia leioderma</i>		small shrub	E
<i>Acacia myrtifolia</i>		Medium shrub	E
<i>Acacia saligna</i>	golden wreath wattle	Medium shrub	E
<i>Agrostocrinum hirsutum</i>		rhizomatous perennial herb	U
<i>Billardiera fusiformis</i>	kummack/bluebell	small to medium twining shrub	E
<i>Billardiera venusta</i>	kurruup	small twining shrub	U
<i>Clematis pubescens</i>	common clematis	creeper	U, ?S
<i>Dianella revoluta</i>	blueberry lily	clumping perennial herb	U, ?S
<i>Gastrolobium praemorsum</i>	cut-leaf pea	low spreading shrub	A, D
<i>Haemodorum spicatum</i>	Mearn/blood root	herb	A, ?D/S
<i>Hakea prostrata</i>		low to medium shrub	S
<i>Hardenbergia comptoniana</i>	native wisteria	vigorous creeper	E
<i>Hovea elliptica</i>	tree hovea	medium shrub	A
<i>Melaleuca thymoides</i>		low to medium shrub grows on sand	E
<i>Microlaena stipoides</i>	weeping rice grass	low spreading grass	E
<i>Tetrarhena laevis</i>	forest rice grass	low spreading grass	E
<i>Xanthosia rotundifolia</i>	southern cross	low spreading shrub may need to be propagated by cutting	D
Zones 3 & 4: Infill planting of understorey under existing trees (proposed 2024 planting season)			
Zone 3: Degraded Marri open forest over coastal peppermint woodland (approximately 0.72 ha) and			
Zone 4: Degraded Marri Open Forest (approximately 0.28 ha)			
Zones 3 & 4 are grouped together because understorey species were very similar			
Note: if coastal peppermint (<i>Agonis flexuosa</i>) is missing on sandy soil, add to the list below (but only plant on sandy soils)			
Botanical name	Common name	Description	Propagation
<i>Acacia drummondii</i> ssp. <i>elegans</i>	Drummond's wattle	small shrub	E
<i>Acacia leioderma</i>		small shrub	E
<i>Acacia myrtifolia</i>		medium shrub	E
<i>Acacia saligna</i>	golden wreath wattle	Medium shrub	E
<i>Agrostocrinum hirsutum</i>		rhizomatous perennial herb	A
<i>Banksia grandis</i>	bull banksia	medium shrub to small tree	S
<i>Billardiera fusiformis</i>	kummack/bluebell	small to medium twining shrub	E
<i>Billardiera venusta</i>	kurruup	small twining shrub	A
<i>Bossiaea linophylla</i>	eggs and bacon	Medium shrub	A, ?S
<i>Clematis pubescens</i>	common clematis	creeper	A, ?S
<i>Dianella revoluta</i>	blueberry lily	clumping perennial herb	A, ?S
<i>Haemodorum spicatum</i>	Mearn/blood root	upright herb	A, ?S
<i>Hakea oleifolia</i>		large shrub to small tree	S
<i>Hakea prostrata</i>		low to medium shrub	S
<i>Hardenbergia comptoniana</i>	native wisteria	vigorous creeper	E
<i>Hovea elliptica</i>	tree hovea		A, E
<i>Kunzea recurva</i>		medium shrub, purple flowers	E
<i>Microlaena stipoides</i>	weeping rice grass	low spreading grass	A, E
<i>Tetrarhena laevis</i>	forest rice grass	low spreading grass	A, ?E
<i>Xanthosia rotundifolia</i>	southern cross	low spreading shrub may need to be propagated by cutting	D

Zone 5: Granite outcrop Infill planting in pockets of soil where weeds are becoming dominant			
south of granite outcrop (proposed 2023 planting) (note: it is hoped to be able to expand this list post spring survey)			
Botanical name	Common name	Description	Propagation
Calytrix hirta		Medium shrub	D
Patersonia occidentalis	flag iris	herb	A, ?E
Stypandra glauca	blind grass	herb	A

Appendix 5: Names and descriptions of invasive weeds and notes on management and control options

Source: 1 Florabase website available at: florabase.dpaw.wa.gov.au

2 Moore & Wheeler (2008) *Southern Weeds and their control*, Bulletin 4744, Department of Agriculture and Food, Western Australia, pp. 64, 65

3 DiTomaso, J.M, G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Centre, University of California. p. 544 viewed online February 2021 at: wric.ucdavis.edu/information/natural%20areas/wr_H/Holcus.pdf.

4 John Moore, DPIRD pers. comm. 18 February 2021

Note: Read the manufacturers' labels and material safety data sheets before using herbicides

Botanical name	Common name	Life form	Reproduction	Dispersal	Management notes	Spray treatment times and frequency	Comments
Family: Asparagaceae Species: <i>Asparagus asparagoides</i>	Bridal creeper	Perennial rhizomatous/tuberous herb and climber	Primarily seed, occasionally rhizome/tubers	Birds, foxes, rabbits, water, soil, machinery	Spray 0.2 g metsulfuron methyl + Pulse® in 15 L water (or 2.5-5g/ha + Pulse®). Best results achieved when flowering. Biological control agents including leafhopper, a rust fungus and a leaf beetle available ¹ .	Spray annually until controlled at early flowering (August) prior to seed set	Extremely invasive, smothers vegetation, forms monocultures, increases fire risk during summer die-off phase ¹ .
Family name: Cyperaceae Species: <i>Juncus microcephalus</i>		Rhizomatous colonial, perennial herb (sedge)	Seed	Water, machinery	Dig out isolated plants. Spray with 2% glyphosate + wetting agent in late summer/autumn if there is surface water present throughout the rest of the year. In dry conditions, apply in spring/early summer.	See management notes for time of spraying annually until controlled	Capsules bear hundreds of very small seeds. Germinates in light, but remains dormant in the dark.
Family name: Orchidaceae Species: <i>Disa bracteata</i>	South African orchid	Tuberous perennial herb	Primarily from seed	Wind	Spot spray glyphosate 1% + Pulse® just on flowering ¹ . Small populations can be dug out but make sure tuber is removed ¹ .	Spray October annually until controlled	

Family	Common name	Life form	Reproduction	Dispersal	Management notes	Spray treatment times and frequency	Comments
Family: Poaceae Species: <i>Anthoxanthum odoratum</i>	Sweet vernal grass	Clump-forming rhizomatous winter active perennial grass	Seed	Water, wind, mammals (on fur), slashing	In small infestations, hand remove plants ensuring rhizomes are removed. If all plant parts are not removed, hand removal as well as mowing can increase the number of inflorescences (flowers heads) and promote growth. Highly sensitive to glyphosate ¹ but in situations where selective control is needed, spray with grass selective herbicide Verdict 520 @ 400 ml/ha with 1% spray oil provides good control in winter/spring when actively growing before appearance of seed head. Follow-up with seedling control ⁴ .	Flowering time most commonly Nov-Dec but occasionally Jan or Sept. Spray in October (prior to flowering) if not already flowering and again following autumn to control seedlings	Seedbank persistence short, up to 2 years Fire response: resprouts, increases in cover due to reduced competition. Forms extensive ground cover and highly competitive with other grasses because of its rapid growth and early flowering. Produces prolific seed. Contains allelopathic chemical that suppress growth of other plant species ¹
Family: Poaceae Species: <i>Avena barbata</i>	Bearded oat	Winter active annual grass	Seed	Wind (short distance), mammals (on fur), machinery	Spray at 3-5 leaf stage with Fusilade® Forte at 16 ml/10L + wetting agent or for generic fluazifop-p (212g/L active ingredient) 10 ml/L or 0.5 L/ha + wetting agent. Repeat over the following 2 years. Aim to prevent seed production ¹ .	Flowers Aug-Oct. Spray out August prior to seed set and monitor following autumn to control seedlings	Seed bank persistence 6 months to 3 years (shorter if not buried) Able to outcompete native grasses. Is allelopathic and forms extensive, fibrous root system. Can increase fire frequencies ¹ .

Family	Common name	Life form	Reproduction	Dispersal	Management notes	Spray treatment times and frequency	Comments
Family: Poaceae Species: <i>Cenchrus clandestinus</i>	Kikuyu	Summer active stoloniferous/rhizomatous perennial grass	Rhizomes, stolons	Grazing animals, soil movement	Difficult to manually control as all rhizomes must be removed. Spray with 100 mL glyphosate (450g/L) plus 25mL Pulse in 10 L water when grass is actively growing is most effective control ² . For selective control 800 mL/ha Verdict®520 ² or Fusilade® Forte at 16 ml/L + wetting agent or for generic fluazifop-p (212g/L active ingredient 10ml/L + wetting agent. 2-3 sprays over a single growing season are often required. Use unplanned fire events to effectively control any regrowth ¹ .	Spray in January and repeat every 8 weeks or when regrowth reaches about 5 cm tall ²	Grows rapidly forming dense mats. Shades and inhibits growth of herbs and shrubs. Known to release allelopathic substances which impact nearby species ¹ .
Family: Poaceae Species: <i>Holcus lanatus</i>	Yorkshire fog or velvet grass	Winter active perennial grass	Seed, tillering	Wind, water, birds, mammals, ants, machinery	Remove isolated plants before they set seed ¹ and be sure to remove the entire plant as can resprout from basal shoots ³ . Spray with glyphosate 0.5% in spring or when the first seed head appears for optimal translocation to roots ¹ . In situations where selective control is needed, spray with grass selective herbicide Verdict 520 @ 400 ml/ha with 1% spray oil provides good control in winter/spring when actively growing before appearance of seed head. Follow-up with seedling control ⁴ . Regular slashing reduces its vigour, but should not be done while plants are seeding. Severe defoliation and repeated herbicide treatment provides the best control. Controlled burning in spring or autumn can be a potential useful tool for suppression ¹ .		Can be a serious weed of freshwater wetlands and wetland margins. Seedbank persistence 3-9 years Likely killed by fire but occasionally resprouts Soil-stored seed may survive and germinate ¹

Family	Common name	Life form	Reproduction	Dispersal	Management notes	Spray treatment times and frequency	Comments
Family: Poaceae Species: <i>Stenotaphrum secundatum</i>	Buffalo grass	Perennial stoloniferous grass	Stolons, occasionally seed	Water, soil movement, dumped soil, machinery	Spray with 1% (100 ml in 10 L water) glyphosate plus 25ml Pulse 2-3 times over a single growing season ² . Alternatively for selective control spray 16 ml Verdict®520 or 80 ml quizalofop (100g/L) or 125 ml Fuselade® Forte plus + 100 ml of spray oil per 10L water for hand sprayers ² .	Nov-May Repeat in 8 weeks or when regrowth reaches about 5 cm tall.	Can readily smother other species because of its dense growth and long-lived mat habit.
Family: Asteraceae Genus & species: <i>Cirsium vulgare</i>	Spear thistle or Scotch thistle	Annual or biennial herb	Seed	Wind, water, machinery, animals – particularly birds collecting silken tassels for nests ¹	Glyphosate at 0.5% provides effective control of seedling and adult plants, alternatively spot spray Lontrel® 6 ml/10L (300ml/ha) + wetting agent. From rosette stage to early flowering. Blanket wipers or wick applicators using 50% glyphosate can provide some selective control. Eliminating seed production is the most effective mechanical control technique. Mowing/slashing at bud or early bloom stage will cause plants to resprout. However, close mowing or cutting twice per season will usually prevent seed production ¹ .	May to September and repeat following year until controlled - prevent seed set for several years ²	Soil disturbance promotes germination which is also stimulated by moisture and/or nutrients. Seeds mature and may disperse within 7-10 days of flowering. Avoid burial of seed. Requires moisture to establish. After germination, a root system develops rapidly while the rosette is more slowly developed above ground ¹ .

Family	Common name	Life form	Reproduction	Dispersal	Management notes	Spray treatment times and frequency	Comments
Family: Asteraceae Species: <i>Erigeron bonariensis</i>	Fleabane	Annual herb	Seed	Wind, water	1 L/ha glyphosate (450g/L) after stem elongation and before flowering in late spring to summer each year when the plants are actively growing. A mixture of 1 L glyphosate (450 g/L) plus 2 L water can be used to wipe the stems of plants. Lontrel®750 at 200 g/ha or 4 g plus 25 ml wetting agent in 10 L water can be used for fairly selective control in bushland. Isolated patches can be sprayed with a mixture of 50 ml Tordon®75-D in 10 L water for control of plants and residual control of seedlings. Hand pulling after stem elongation is effective on loose soils, but on heavier soils, a weed fork is required to prevent the plant from breaking and regrowing from the base. Mowing is not effective ² .	November or after stem elongation and before flowering annually until controlled	Planting perennial species to increase ground cover and shade will help reduce re-infestation ²
Family: Fabaceae Species: <i>Acacia longifolia</i>	Sydney golden wattle	Shrub or tree	Seed	Water, bird, ants, soil movement	Hand-pull seedlings. Fell mature plants. Apply 250 ml Access® in 15 L of diesel to basal 50 cm of trunk, or cut and paint or drill and fill with 50% glyphosate. Older plants can be ringbarked. Monitor site for recruitment from seedbank ¹ .	March to August. Monitor site for recruitment and hand pull while small	Similar in appearance to <i>Acacia saligna</i>

Family	Common name	Life form	Reproduction	Dispersal	Management notes	Spray treatment times and frequency	Comments
Family: Phytolaccaceae Species: <i>Phytolacca octandra</i>	Ink weed	Erect perennial spreading herb or shrub	Seed	Birds, foxes	Hand pulling is ineffective if root is not removed and allowed to re-grow. Dig out isolated plants and cut root at least 5 cm below ground level. Otherwise spray with 1% glyphosate + Pulse®. Small infestations can be controlled with 100 mL Tordon®75-D in 10 L water. This will control existing plants and has residual activity for control of seedlings ²	October to December prior to flowering, Monitor for seedlings spread by birds from infestations within 5 km ²	Generally appears after disturbance such as clearing or fire. Aggressive growth can suppress any other plants growing beneath it.
Family: Rosaceae Species: <i>Rubus ulmifolius</i>	Blackberry	Straggling perennial, herb or shrub	Seed, stem layering, suckering	Birds, foxes, other mammals	For small infestations or in sensitive areas, hand pull small plants or seedlings. For larger plants, cut and paint with 20-50% glyphosate or slash canes. Spray regrowth at 50cm with metsulfuron methyl 1 g/10L + the wetting agent Endose® @ 30 ml/10L, in summer-autumn ¹ .	Dec – Feb. annually until controlled.	Resprouts after fire, seed germination triggered by disturbance
Family: Solanaceae Species: <i>Solanum nigrum</i>	Black berry nightshade	Erect annual herb or shrub	Seed	Birds, water, soil, machinery	Prevent seed set for several years. Hand weed small infestations. In bushland situation, manually remove plants before flowering. For large infestations, 1L/ha Starane® (20ml/L) applied when actively growing in summer, will provide reasonably selective control. Do not use in or near wetlands. Control infestations within 5 km of the target area to reduce dispersal of seed by birds. 1L/ha 2,4D-amine (500 g/L) or 20 ml/10L can also be used for control of young plants in early summer.	July to December, annually until controlled. Monitor for seedlings spread by birds from up to 5 km away ¹ .	Seedbank persistence maybe 5+ years. Encourage shrub species and litter build up to reduce re-infestation. Blackberry nightshade usually only germinates in bare soil ² .

Appendix 6: Priority actions and budget

Note: Add on 3% CPI for 2023 Form Forests quotes

Line item	Zone & ha	Operation	Year	Season/Month	Task	\$/day	No. days	Total \$			
1	All zones (6 ha)	Weed control	2020-2023	August or early flowering	Reconnaissance for Bridal creeper & Sydney golden wattle & control	800	3	2400			
2	1 (1 ha)		2021	As soon as dry enough to get on: late winter/early spring when actively growing before appearance of seed heads	Sweet vernal grass & yorkshire fog: Boom spray with 400 ml Verdict@520 plus 1% spray oil if grass selective needed or frog-friendly glyphosate product (eg Glyphosate 360 frog friendly) at label rates. Broad leaf weeds as needed	800	2	1600			
3	1 (0.25 ha)		2021	When conditions are dry spring/early summer	Juncus microcephalus: 2% glyphosate + wetter (frog friendly roundup)	800	0.5	400			
4	1 (1 ha)		2022	Autumn when safe	Burn dry grass	250	4	1000			
5	1 (1 ha)		2022	As soon as dry enough to get on: late winter/early spring when actively growing before appearance of seed heads	Sweet vernal grass & yorkshire fog: Boom spray with 400 ml/ha Verdict@520 plus 1% spray oil if grass selective needed or frog-friendly glyphosate product (eg Glyphosate 360 frog friendly at label rates	800	2	1600			
6	1 (1 ha)		2022, 2023	As soon as dry enough to get on: late winter/early spring when actively growing before appearance of seed heads	Provisional budget for grass selective weed control and strategic broad leaf weed control	800	2	1600			
					Sub total			8600			

Line item	Zone	Operation	Year	Season/Month	Task	No. days/sdlings	\$/day	Total \$	No. sdlings	\$/sdling (excl. gst)	Total \$ sdlings
7	1 (1 ha)	Revegetation	2021	October	Engage technical expertise to undertake site visit to map soil types, order seedlings in negotiation with nursery incl. travel	2.5	900	2250			
8	1 (1 ha)		2021	October	1250 seedlings (2x4m spacings for 1 ha) 75% @ \$0.65, 25% @ \$2.50				938	0.65	609.70
9	1 (1 ha)		2021	October	1250 seedlings (2x4m spacings for 1 ha) 75% @ \$0.65, 25% @ \$2.50				313	2.50	782.50
10	1 (1 ha)		2022	Spring after weed control completed while still good moisture	Plant seedlings with pottipukis with technical support incl. travel=1.5 daysX\$900/day+ AHRGAC help plant (4x1dayx\$250)	1	2350	2350			
11	1 (1 ha)	Monitoring	2022-2023	Early summer & autumn	Monitor survival and weed control - technical support 4 days incl. travel @ \$900/day plus AHRGAC 3X4X\$250	4	1650	6600			
13	All zones		2022, 2023	Spring	Fauna survey	2	900	1800			
Sub-total								10000			1,392.20
Total weed control bridal creeper, seedling survival and fauna monitoring and Zone 1 over 3 years + seedlings 2022 planting								19,992.20			

Line item	Zone	Operation	Year	Season/Month	Task	\$/day incl chemical	No days	Total \$			
14	3 & 4 (1ha)	Weed control	2022	Spring before seed heads emerge on grasses	Spray out weeds (expected to be mostly sweet vernal grass) with motorbike-mounted sprayer in areas identified in task in line item 17 (expected to be grass weeds) with 400 ml/ha Verdict 520 if grass selective needed and otherwise glyphosate 0.5%	800	1.5	1200			
15	?2, 5 (1 ha)		2022	Spring before seed heads emerge on grasses	Spot spray (expected to be mostly sweet vernal grass) between revegetated plants in Zone 2 where accessible with hand sprayer/knapsack (Verdict/glyphosate at label rates)	800	1	800			
16	3 & 4 (1ha)		2023	Autumn/early winter	As for line 12 above	800	1	800			
17	?2, 5 (1 ha)		2023	Autumn/early winter	As for line 13 above	800	1	800			
18	3 & 4 (1ha)	Deep ripping	2023	After spraying is completed and visual area covered is detectable	Deep rip 1.5 m spacings where ever accessible areas that have been sprayed out	800	1.5	1200			
					Sub-total			4800			

Line item	Zone	Operation	Year	Season/Month	Task	No. days	\$/day	Total \$	No. seedlings	\$/seedling (excl. gst)	Total \$ seedlings
19	3 & 4 (1 ha), 72, 5 (1 ha)	Revegetation	2022	Spring	Undertake reconnaissance with AHRGAC & South Coast NRM to determine & map manageable target open areas and soil types that allow machinery access for weed control and deep ripping and to ground-truth relevant target weeds for weed control and vegetation communities for revegetation. Technical support 1 day incl travel @ \$900/day + AHRGAC 4 people @ \$250	1	1900	1900			
20	3 & 4 (1 ha), 72, 5 (1 ha)		2022	Spring	Technical support to negotiate with nursery and order seedlings	1	900	900			
21	3 & 4 (1 ha), 72, 5 (1 ha)		2022	Spring	1750 understorey seedlings ordered 75% @ \$0.65, 25% @ \$ 2.50			0	1313	0.65	853.45
22	3 & 4 (1 ha), 72, 5 (1 ha)		2022	Spring	Seedlings as above 25%			0	438	2.50	1,095.00
23	3 & 4 (1 ha), 72, 5 (1 ha)		2023	Early winter	Plant seedlings with pottipukis with technical support incl. travel. Assumption that AHRGAC volunteer??	1.5		0			
24			2023		Review EPMP and suggest priority actions for the next five year period			8000			
					Sub-total			11,800			1,948.45
					Total Weed control + seedlings all zones			10,548.45			
					Grand total			38,540.65			

Appendix 7: *Phytophthora* Dieback Dieback Management for Remnant Vegetation: Hygiene Notes

Source: South Coast NRM (n.d.)

The protection of dieback free remnant vegetation in building wildlife corridors is a priority for the South Coast community. The distribution of disease across the South Coast (from Walpole to east of Esperance) is chronic. Very few large uninfested patches of bush remain. Dieback free bush in reserves and private property offers a great opportunity to protect these plant and animal communities. Some of these may be the last examples of disease free communities occurring anywhere on the South Coast and you have the greatest ability to control access to these areas and protect these important areas of bush from this disease.

If you have areas of bush that is in good condition (minimal grazing impact and fenced off, no weeds etc) and you suspect it is free of dieback it is important to consider ways to protect this by minimising the movement of infected soil (via machinery, equipment and other materials like plants) to the area. Some activities and actions to consider:

- Consider activities that are conducted adjacent to/in the area like maintaining fire breaks, fencing, grading etc. ***(This will help establish the disease risks to the area/s.)***
- Is the equipment and vehicles going to this area free of soil and materials? ***(Taking soil and other material that could be/is infected into the area to be avoided.)***
- Ensure work is carried out in dry soil conditions. ***(One of the easiest hygiene approach as very low risk of picking up infected soil/mud in these conditions.)***
- Plan works and activities to start in areas NOT infested. ***(By starting with clean machines and equipment you can ensure you are not introducing the disease and then work can move to other areas without significant interruption to works plans.)***
- Do you have known infested bush in the project site and what activities occur in this area? ***(Establish what activities could be moving infected soil from here to areas you are trying to protect.)***

What to look for:

- Death of indicator species (Common and reliable indicators include grass trees, banksias, dryandras, chitticks). Start looking in moisture gaining sites and when conditions are warm and soil is moist you will see “fresh deaths” which will be a bright yellow/golden colour.
- Generally dieback will destroy the plant completely - partial death of limbs is likely to be from other causes.
- A range of indicator species provides greater confidence in determining disease presence.
- There should be an age range in plant deaths - from plants with no leaves, to a plant with brown leaves, to a plant that has recently died and is a fresh expression (the bright yellow/golden colour).

Common NRM activities and associated dieback minimization strategies

Fencing of remnant and riparian vegetation

- When adjacent to native vegetation, ensure that all tools and machinery are free of mud or soil. (including tyres, vehicle, underbody, trailer, chain links, buckets, augers, post hole diggers, star pickets, etc)
- Wherever possible install posts using a ram rather than an auger.
- Try not to transport soil between post/hole sites via equipment etc – more importantly not into uninfested bush.
- Work from dry (high points) to wet (low points) in each paddock.
- Brush soil from footwear and equipment and spray with 70% methylated spirits to disinfect between sites.

Revegetation (seedlings and direct seeding) and Rehabilitation

- Direct seeding is preferred over seedlings as the latter poses a risk to introduction of dieback.
- If using seedlings, source stock where possible from nurseries with Nursery Industry Accreditation Scheme Australia (NIASA) accreditation (See list of nurseries attached).
- If using mulch, ensure that it has been well composted (the heating process kills Phytophthora).

Weed Control

- If weeds are being manually removed they should immediately be placed in a container to prevent the spread of potentially infected plant or soil material.
- Weed/spray from dry (high points) to wet (low points) in bushland or stay high/low in the landform profile while weeding or spraying.
- Brush soil from footwear and equipment and spray with 70% methylated spirits prior to moving to next weeding site area.

Feral Animal Control

- If trapping or baiting, ensure traps and equipment is clean before placement at the site.
- Use existing feral animal tracks to traverse while staying preferably low or high in the profile depending on the dieback status of the bushland area. Avoid traversing between low and high points.
- Place traps or baits in low points rather than high in the profile.
- When relocating traps and baits, brush soil/plant material and disinfect footwear and equipment prior to moving to next trap site.
- Remove trapped animals from the site following recommended procedures for feral animal control programs.

Photo points

Photo points are sites you intend to visit repeatedly to take photos to show change. To ensure that photos taken from these points give the best opportunity for comparison the photos need to be taken under similar conditions eg in the morning, with the same camera setting eg focal length, of the same landscape. The following information should be recorded when setting up the site and when taking the photos.

Photo point site code

Photo points are given unique names using a standard code.

P	H	1	2	3	A	K
Code for photo point	Unique number (3 places)			Authors initials		

Taking more than one photo from the same point

More than one photo may be taken from each point eg in different directions or different zooms. The naming protocol in this situation is to use the photo point site code with dash number before the initials

Eg PH123-1AK

Naming images

Each image taken at a photo point will have a name composed of the photo point site code, underscore (_) then date as below. Always use 2 digits for the day, the first 3 letters of the month then 2 digits for the year.

Eg. PH123AK_01Aug07.jpg or PO456-1BH_02Sep07

Data to be recorded about each photo point site

These photo point codes and their associated information will be stored in a central photo point data base (such as excel). There is also a form (end of this document) to use in the field to record this information.

- Name of site (see convention above)
- Established by
- Date established
- GPS reading (lat/long or E and N) and GPS datum-coordinate system (eg GDA-94, MGA, UTM)
- Direction camera points
- Elevation of camera, and camera orientation (landscape versus portrait)
- Focal length

Appendix 9: Monitoring templates

Photo point establishment

Record details for each photo point established. This information then needs to be entered into the database. Note – if more than one photo is taken at each site, details need to be recorder for each.

Photo point code:	Date established:	Time:
Established by:	GPS reading	GPS Datum/coordinate system
Direction of photo:	Elevation of camera:	Lens focal length (mm):
Property name:	Location number:	Road address:
Purpose of photo:		Associated site codes:
Description of location:		

Photo point code:	Date established:	Time:
Established by:	GPS reading	GPS Datum/coordinate system: UTM
Direction of photo:	Elevation of camera:	Lens focal length (mm):
Property name:	Location number:	Road address:
Purpose of photo		Associated site codes:
Description of location:		
Visual reference points and other observations:		

Photo point code:	Date established:	Time:
Established by:	GPS reading	GPS Datum/coordinate system: UTM
Direction of photo:	Elevation of camera:	Lens focal length (mm):
Property name:	Location number:	Road address:
Purpose of photo:		Associated site codes:
Description of location:		
Visual reference points and other observations:		

Details on photo point photos

These details must be recorded for each photo taken at a photo point.

Photo point code: PH	Photo number in your camera:	
Photographer:	Date:	Time:
Weather:		
Observations including names of people in photos:		

Photo point code: PH	Photo number in your camera:	
Photographer:	Date:	Time:
Weather:		
Observations including names of people in photos:		

Photo point code: PH	Photo number in your camera:	
Photographer:	Date:	Time:
Weather:		
Observations including names of people in photos:		

Photo point code: PH	Photo number in your camera:	
Photographer:	Date:	Time:
Weather:		
Observations including names of people in photos:		

Photo point code: PH	Photo number in your camera:	
Photographer:	Date:	Time:
Weather:		
Observations including names of people in photos:		

Photo point code: PH	Photo number in your camera:	
Photographer:	Date:	Time:
Weather:		
Observations including names of people in photos:		

MONITORING REPORT PROFORMA

Name of Assessor/s:

<p>Site:</p> <p>Landowner Name and Contact:</p> <p>Visit Number and Date: 3, 17 November, 2010</p>

Photo Monitoring Point (PMP)	GPS Points	Percentage Survival
1		
2		
3		

Notes relating to patch assessment: (Monitoring Contractor to complete):

DETAILS OF RISK ASSESSMENT UNDERTAKEN

Provide details of how the following criteria may have impacted survival of the site, either over all or a PMP or at a patch.

Risk	Details	Recommended Actions
A. Weed management		
B. Site selection		
C. Soil testing and hydrology		
D. Species selection		
E. Seedlings or Seeds Planted		
F. Site preparation and tree planting		
G. Local and Feral Predators: Stock Locusts Rabbits Kangaroos		
H. Fencing		
I. Absentee Landlords		
J. Lessons learn:		

DETAILS AT PHOTO MONITORING POINTS (PMP)

PMP : (insert photo)

Direction of Transect:

General condition of area:

0 – 25%	25-50%	50-75%	75-100%
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Comments (including pests, actions required):

Growth Rate:

Poor	Average	Healthy	Vigorous
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PMP :

Direction of Transect:

General condition of area:

0 – 25%	25-50%	50-75%	75-100%
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Comments:

Growth Rate:

Poor	Average	Healthy	Vigorous
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Comments (including pests, actions required)

DATA SHEET TO RECORD GERMINATION OF DIRECT SEEDING AND SEEDLING PLANTING IN LINES USING REPETITIVE SAMPLING (form adapted from Mercer 2000)				
Recorder:		Date:		
Samples (100 metre lengths)	Farm:			
	Site 1:		Site 2:	
	Direct seeding	Seedling planting	Direct seeding	Seedling planting
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Total No				
plus 10%				
Average (Total No/10)				
Plants/km (Av * 10)				
Plants/ha (Ni/km * 3)				
%Survival of planted seedlings (need to know original spacing)				
Total direct seeding + seedling planting/ha				