Australian Botanic Gardens Shepparton

Natural Vegetation Survey

Friends of the Australian Botanic Gardens Shepparton 2018

For the Friends of the Australian Botanic Gardens Shepparton, May 2018

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The companion document is ABGS Natural Vegetation Restoration Plan, June 2018

Contents

Background

The Friends of the Australian Botanic Gardens Shepparton (ABGS) have asked that the natural vegetation on the gardens site be surveyed to inform planning and management. The Friends hope to restore the bushland to use it for educational as well as recreational purposes.

This report contains descriptions of the vegetation types present, an assessment of the vegetation condition, an opinion on the significance of the vegetation and general recommendations for its future management. Preliminary lists of native and weed species are appended to the report.

The map of vegetation condition produced during this survey was hand-drawn on large format aerial imagery. It will be digitally formatted for future use.

Site description

The Australian Botanic Gardens Shepparton is located at the end of Botanic Gardens Avenue (formerly Kialla Tip Road) off Riverview Drive in Kialla. It adjoins private land to the east, south and west, the railway reserve to the north and the Broken River in the north-east corner.

The 27 hectare site consists of 15.4 hectares of borrow pits and a mound, now landscaped as "Honeysuckle Rise", which is the rehabilitated former Kialla tip. 11.6 hectares of natural vegetation remain along the west, north and north-east boundaries.

The ABGS is situated within the still-vegetated corridor of the Goulburn and Broken Rivers. Although the property to the south has been cleared for farming, the properties to the east and west and the rail reserve still carry remnant vegetation. The rail reserve has many large River Red Gums and patches of good quality native understorey. The property to the west has a woodland of younger River Red Gums, Silver Wattle and patchy native understorey. The property to the east has Grey Box woodland and River Red Gum riparian forest, both with large trees, although the understorey vegetation has been removed by grazing. This surrounding vegetation supports and adds value to the vegetation within the site.

Site history and general condition

Although apparently natural bushland, the site has had a long history of use that has had many negative consequences for the vegetation.

The original vegetation would have contained very large trees, closely spaced near the river and more widely spaced elsewhere. There would have been a few varieties of smaller trees scattered here and there and patches of dense shrubs, especially on the banks of the billabong and river. Ephemeral ponds would have been interspersed with low rises covered in Buttercups, Violets, chocolate flowers daisies and other wildflowers (Ray, pers.comm). It would have been always green as it regularly flooded and was often burnt for rejuvenation by its indigenous managers.

The lack of large stumps at the site now suggests that, except for the river and billabong margins, the site was cleared of timber very early on. The small size of most of the River Red Gums suggests repeated harvesting of timber harvesting from the site until recent times.

The highest diversity of plants occurs on the Crown Water Frontage in the north-east corner of the site and in the adjacent railway reserve. Long periods of constant grazing of the private land that later became the tip would have destroyed many species of shrubs, herbs and orchids and most of the Kangaroo Grass which would have been once common throughout the drier areas. Onion Grass might have been introduced via stock or stock feed at this time.

In the 1950s, floodwaters often isolated the sandhills to the west and clear shallow water lay across the paddocks, sometimes for as long as six weeks (Ray, pers. Comm.) Since the construction of Eildon Weir, the frequency and longevity of flooding in the area has greatly diminished. The construction of the railway would have altered the drainage of the site, impeding and altering the course of flood flows. The drain beside the railway has probably caused the wetlands to hold less water and to dry out more quickly. With the excavation of borrow pits for tip capping, the additional artificial drainage would have made the whole northern edge far drier than it once was.

It is not known whether the drainage of the billabong has been altered with earthworks, but it seems likely that it too would now hold floodwater for briefer periods than formerly as there has been soil disturbance to the floor of the billabong where it meets the Broken River at its northern end.

During the use of the site as a tip from the 1970s, the bushland area suffered a patchwork of damage from vehicles, the dumping of earth, weeds and other rubbish and the removal of topsoil. The patches of Soursob throughout the site are probably a relic of this time.

After the closure of the tip in 19xx, the refuse was capped with clay excavated from the extensive borrow pits. The site was then opened to mountain bike riders, but use was discontinued in 2010 due to severe erosion. Grazing by cattle of the bushland areas continued until 2011.

During recent railway bridge construction works, the northeast corner of the site was used as a vehicle depot, leaving denuded tracks, disturbed soil and major weed invasion. The most damaging introduction has been Ribwort which has already spread through much of the bushland area.

Figure 1: Repeatedly coppiced stumps and immature trees are evidence of recurrent past timber harvesting.

Figure 2: These hummocks in the wetland are pugging damage due to past grazing while wet.

Figure 3: During use as a tip rubbish was strewn throughout the site.

Figure 4: Disturbance of soil by vehicles has supported an invasion of Ribwort (Plantago lanceolata).

Vegetation Communities

Five Ecological Vegetation Communities (EVCs) are present within the remnant bushland: Sedgey Riverine Forest, Floodway Pond Herbland, Riverine Grassy Woodland, Plains Woodland and Riverine Swampy Woodland. Refer Appendix 3: Vegetation Type Map ABGS Bushland for their distribution across the site.

Sedgey Riverine Forest EVC (8%)

This vegetation occurs next to major rivers where flooding is regular and occasionally prolonged. Here, floods are generated by both the Broken and Goulburn Rivers (although river regulation and irrigation has grossly altered flooding frequency and volumes). It occurs on the highly undulating terrain of the Broken River banks. It is characterised by closely-spaced, large, tall River Red Gums with Silver Wattle and Grey Parrot-pea underneath and River Sedge, Common Tussock-grass and Warrego Summer-grass in the ground layer. The original vegetation would have had a greater variety of herbs and shrubs such as Pale-fruit Ballart on the higher areas and River Tea-tree and River Bottle-brush close to the water.

Floodway Pond Herbland EVC (4%)

The floor of the billabong remains inundated for the longest time during a flood. Consequently the Floodway Pond Herbland is dominated by ephemeral herbs such as Joyweed, Old Man Weed, Jersey Cudweed and Cotton Fireweed. It is edged by rushes, sedges, perennial herbs and Warrego Summer-grass.

Figure 5: ***Sedgey Riverine Forest EVC***
River Sedge (Carex gaudichaudiana) and Common Tussock-grass (Poa labillardieri) are typical on banks and rises.

Figure 6: ***Floodway Pond Herbland EVC***
Ephemeral herbs with fringing rushes are typical of the billabong floor.

Riverine Grassy Woodland EVC (70%)

This vegetation community occurs near major rivers on higher ground that is regularly flooded. Here, this vegetation extends across the northern and western parts of the site and makes up most of the remaining natural vegetation. In the far north-west corner of the site a depression develops into a small runner that delivers Goulburn River water into the site during floods and drains it back when levels recede.

This vegetation is dominated by River Red Gum and has scattered Silver Wattle and patches of Grey Parrot-pea. Common Tussock-grass dominates the ground layer but there is also a diverse mix of grasses, rushes, herbs and lilies such as Silky Brown-top, Late-flowering Flax-lily, Australian Buttercup, Blue Devils, Chocolate Lily and Bulbine Lily, the species composition varying with micro-relief. The original vegetation would have had far larger trees much further apart, a richer array of herbs and more Kangaroo Grass (only one tussock was found).

Figure 7: ***Riverine Grassy Woodland EVC***

Grey Parrot-pea (Dillwynia cinerascens), Early Nancy (Wurmbea dioica), Austral Buttercup (Ranunculus lappaceus) & Grassland Wood-sorrel (Oxalis perennans)

Plains Woodland EVC (15%)

This vegetation community occurs across the plains in our region. Here, it occurs on the highest ground, mostly near the billabong. It is characterised by Grey Box with a grassy understorey containing species such as wallaby grasses, Knob Sedge, Nodding Saltbush, Black-anthered Flax-lily and Wattle Mat-rush. The original vegetation would have contained a far greater diversity of species including scattered Buloke, patches of Sweet Bursaria, Golden Wattle, Gold-dust Wattle, Mallee Wattle, Spreading Eutaxia, and open areas of low vegetation composed of a rich variety of saltbushes, grasses, herbs, lilies and ferns. As indicated by the Grey Box woodland on the private land to the east, it is likely that Grey Box woodland would have once extended over at least some of the area now occupied by the mound and the borrow pits.

Note that there is a small island of Plains Grassy (Grey Box) Woodland on the highest ground between the river and the billabong that probably remains above the level of all but the highest floods. At least one tree there appears to be scarred by aboriginal use which would add cultural significance to this special spot.

Figure 8: ***Plains Woodland EVC***

Curly Windmill Grass (Enteropogon acicularis), Nodding Saltbush (Einadia nutans), scarred Grey Box and Nodding Chocolate-lily (Arthropodium fimbriatum)

Riverine Swampy Woodland EVC (3%)

This vegetation occurs in two linear depressions within the Riverine Grassy Woodland area that hold shallow water after flooding and after winter rain. These wetlands have cracking clay soils. They naturally have no shrubs and few trees and contain grasses, sedges and herbs such as Rush Sedge, Common Spike-sedge, Small Spike-sedge, Blown Grass, Narrow-leaf Nardoo, Swamp Billy-buttons and Old Man Weed. In the past the wetlands might have been more extensive and held deeper water for longer.

Figure 9:
Riverine Swampy Woodland EVC *with Swamp Billy-buttons (Craspedia paludicola)*

Swamp Daisy (Brachyscome basaltica), Tufted Burr-daisy (Calotis scapigera), Slender Bitter-cress (Cardamine moirensis) with Narrow-leaf Nardoo (Marsilea costulifera)

Survey of Vegetation Condition

The past management of the site has resulted in a mosaic of vegetation of varying quality. To assist with management, the condition of the vegetation was assessed and mapped onto 1:500 aerial imagery provided by Greater Shepparton Council. Refer Appendix 4: Vegetation Condition Map AGBS Bushland.

Three characteristics of the vegetation were used as indicators of quality.

- **The diversity of native species**. This is a comparative assessment of how many native species were growing together. It also incorporates the concept of rarity as rarer species mostly occurred where there was more diversity and vegetation with less diversity generally had only common species.
- **The amount of native plants versus weedy plants**. This was judged by how much ground was covered by each. Three simple categories were used: far more natives than weeds, roughly half and half or definitely more weeds than natives.
- **The type of weeds**. A distinction was made between perennial weeds (or a mix of perennials and annuals) and mostly annual weeds such as rye grass. This is because the control of perennials is far more difficult than annuals and there is the risk that vegetation will be further degraded in the process of controlling them.

These characters were combined to produce six categories of vegetation condition.

Condition 1 High diversity **-** More natives - Less weeds

Condition 2 High diversity - Half natives - Half weeds

Condition 3 Moderate diversity - More natives - Less weeds

Condition 4 Moderate diversity **-** Half natives - Half weeds

Condition 5 Low diversity - Less natives - More weeds, mostly annual grasses

Condition 6 Low diversity - Less natives - More weeds, including perennials.

The priorities and possibilities for restoration and the techniques required will vary greatly between these categories.

Condition 1: Clearly, the priority for work. With fewer weeds to remove, there is a high chance of achieving healthy resilient vegetation. This vegetation will be the source of propagules for restoration in other areas.

Condition 2: Problematic, but should still be second priority, at least for the control of invasive and competitive weed species. This is high value vegetation but requires far more work and risks some degradation. The best outcome will probably be high diversity with some weeds remaining.

Condition 3: Third priority. These areas are less diverse but much easier to manage because there are few weeds that are more easily dealt with. Some species could be seeded into Condition 3 areas after weeds are controlled to improve diversity.

Condition 4: Fourth priority. In these areas it would probably be only worth targeting competitive and invasive weeds and using broad-scale techniques to suppress other weeds.

Condition 5: Low priority. These areas will require revegetation after weed control.

Condition 6: Lowest priority except where adjacent to Category 1 or 3 areas or areas being worked on where they become a potential source of weed invasion. Will require thorough weed control and complete revegetation.

It should be noted that the mapping is a generalisation of vegetation condition. Within each mapped area there will be anomalies which should be managed with the same priority as the larger zone they lie within. For example a disturbed weedy patch found within a Condition 1 area should be treated as a priority. A small patch of natives within a Condition 5 or 6 area would not be managed as a priority - although the plants should still be flagged for protection.

Figure 10: Example of Condition 3 Riverine Grassy Woodland vegetation with only moderate diversity of native species but very few weeds. Note the valuable vegetation in the railway reserve in the left background.

Significance of the vegetation

In northern Victoria, so much of the original vegetation has been cleared for agriculture that any remaining natural vegetation is valuable. So little remains of some communities and some species however, that they are recognised as being threatened with extinction.

Within the Victorian Riverina Bioregion (northern Victorian plains),

- Plains Woodland EVC is considered to be **Endangered** with extinction with only 0.9% of the previous extent remaining.
- The mosaic of Riverine Grassy Woodland/Riverine Swampy Woodland/Sedgey Riverine Forest/Floodway Pond Herbland EVCs is considered as a unit to be **Vulnerable** to extinction with only 29% remaining.

At the national level,

- Plains Woodland EVC falls within the definition of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.* These woodlands are listed under the Commonwealth Government's Environment Protection and Biodiversity Conservation Act (EPBC)(1999) as **Endangered.**

Protection and restoration of the Plains Woodland EVC vegetation would be a high priority for management.

Plants of significance include:

- Moira Bitter-cress *Cardamine moirensis* which is classified as **Rare** in Victoria.
- Australian Buttercup *Ranunculus lappaceus*, which was once widespread in Victoria, but is now "rare in lowland woodlands" (Flora of Victoria 2017).
- Blue Grass-lily *Caesia calliantha* is "an uncommon species across its range" (Flora of Victoria 2017).

Fauna of significance include:

- Squirrel Glider which is classified as **Endangered** in Victoria and is a Listed Species under the Victorian Flora and Fauna Guarantee Act 1988). Squirrel Gliders have been found to be present in nest boxes erected in the bushland by the Shepparton Mooroopna Urban Landcare Group (Wendy D'Amore, pers. comm.). It is likely they also utilise natural hollows in the large old River Red Gums and Grey Box in the billabong area.
- Some woodland birds are also present. Murray Goulburn Bird Observers conduct regular surveys of birds populations at ABGS. The Victorian Temperate Woodland Bird Community is a Listed Community under the Victorian Flora and Fauna Guarantee Act 1988. Restoration of the Plains Woodland vegetation (Grey Box) will be critical for maintaining these species.

The advice of wildlife ecologists should be sought on how best to maintain and improve resources for important fauna species.

Government funding to support the conservation of threatened species and communities might be available from time to time.

Figure 11: The rare **Moira Bitter-cress (Cardamine paucijuga)** *is an ephemeral herb in the Riverine Swampy Woodland.*

*Figure 12****: Australian Buttercup (Ranunculus lappaceus****), **Blue Grass-lily (Caesia calliantha)** and **Austral Flax (Linum marginale)** are all uncommon species in the region.*

Threats to the vegetation

Weeds

Weeds are competitive plants that can out-do most natives in the race for space, light, moisture and nutrients. Some weeds (such as Annual Rye-grass) exude chemicals from their roots that further suppress growth in other plants. Bulky weeds smother the soil surface preventing the germination of native species and can also harbour pest species which can further weaken natives.

Weeds also confuse people about how native vegetation should look. The natural vegetation at ABGS is intended to play a role in environmental education so it is important that it looks as uncontaminated as possible and if necessary, that visitors understand which plants are weeds and why they are there.

Perennial Weeds

Perennials are persistent plants, even if their foliage dies down, so their control requires physical or chemical removal. Physical removal of underground parts is not recommended as soil disturbance is likely to lead to further weed problems. Chemical treatment requires the careful choice of chemicals, timing and application technique that will kill the weed with minimal damage to surrounding plants.

The most troubling perennial weed here is Ribwor**t** *Plantago lanceolata* which has rapidly and extensively invaded the bushland. Priority should be given to limiting further spread by treating all isolated and small infestations and by preventing seeding or removing seed-heads.

St. John's Wort *Hypericum perforatum,* which is mostly in the area that was used as a depot for bridge works, is also important to control as it is easily spread by animals and people.

Soursob *Oxalis pes-caprae* slowly but steadily expands and eliminates most competitors. There are many small patches throughout the site.

Other perennial weeds that should be controlled include Lippia *Phyla nodiflora* which is mostly near the billabong, Rice Millet *Piptatherum milleaceum* which is in three patches near where the billabong drains into the river and Paterson's Curse *Echium plantagineum*, Paspalum *Paspalum dilatatum* and Phalaris *Phalaris aquatica,* which are scattered and not extensive.

Onion Grasses *Romulea rosea* and *Romulea minutiflora* are common across large parts of the drier areas of the site. Unfortunately they are difficult to control when they are amongst native herbs and lilies.

Annual weeds

Annual weeds grow rapidly - most in winter - set seed, then die, so timing is critical for control. They are dependent on a soil seed bank to re-establish themselves each year and this can be depleted by repeatedly preventing seed set by slashing or burning which will not damage native herbs and grasses.

Woody weeds

Although there are not many woody weeds, they are unsightly and most can be easily killed by cutting and poisoning. Most are fruiting species which are eaten and re-distributed by birds: Cherry Plum *Prunus cerasifera*, Boxthorn *Lycium ferocissimum*, Madiera Winter Cherry *Solanum pseudocapsicum,* Olive *Olea europaea* and Sweet Briar *Rosa rubiginosa*, although Desert Ash *Fraxinus angustifolia* has wind-borne seed. They are worth removing as they appear, before they flower and produce seed, as they will continue to be spread. It is important that woody weeds with wind-borne and bird-distributed seed are also treated on the adjacent railway and private land.

Out-of-place natives

Early Black Wattle *Acacia decurrens*, Flinders Wattle *Acacia iteaphylla*, Spiny Mat-rush *Lomandra longifolia*, Drumsticks *Pycnosaurus globosus* and some other planted species are not indigenous to the site. Golden Wattle *Acacia pycnantha*, River Bottlebrush *Callistemon seiberi* and others do belong in the area, but have been planted in the wrong places (wrong vegetation communities).

Even River Red Gum saplings might be considered out-of-place in some instances. Because of damage to the original vegetation, red gums have invaded Plains Grassy Woodland (Grey Box) vegetation and should probably be removed to preserve the small areas of Plains Grassy woodland that remain.

New weeds

Because the site is surrounded by unmaintained and exotic vegetation, and especially after flooding, new weed species will continue to appear. Vigilance will be required to identify and destroy any problematic species before they become established.

*Figure 13: **Soursob, St.John's Wort** and **Ribwort** are important perennial weeds to control.*

*Figure 14: **Annual grassy weeds** dominate the ground layer in Condition 5 vegetation.*

*Figure 15: There are scattered **woody weeds** throughout the bushland such as this Desert Ash.*

Soil disturbance

Soil disturbance damages the soil crust (which is mostly no longer present in Condition 5 & 6 vegetation) and brings nutrients and new weeds seed to the surface helping weeds replace native plants. Soil dumped or excavated long ago that has largely been colonised by natives is best left alone. However there are numerous piles of earth that are covered in weeds. These piles should be treated and carefully removed to reveal the original soil if it can be done without causing further damage.

Soil disturbance during weed work should be avoided. Cut and paste or stem inject woody weeds. Always use herbicides on bulbs and corms instead of digging them out. Do not introduce any material (such as mulch or gravel) that might contain nutrients or weed seed. Similarly do not throw soil or leaf litter around in any bushland areas and strictly keep vehicles on paths.

Structures should really be kept out of bushland areas. If absolutely necessary, minimise the area taken up and carefully choose locations in Condition 5 or 6 vegetation.

Pest animals

Numerous hares and the diggings of rabbits (but no warrens) were sighted during the survey. Hares and rabbits might target susceptible plant species and could prevent successful revegetation. Measures should be taken to control them. Eastern Grey Kangaroos do not appear to be having negative impacts on vegetation but might become a future problem as they have elsewhere. Motion cameras and simple animal exclosures can provide useful information for designing control programs.

Consideration could also be given to cat and fox control for the protection of birds, reptiles, and small mammals.

Vandalism

The only vandalism currently apparent is the riding of motorbikes next to the fence in the adjacent rail reserve. This land does not belong to ABGS, however Condition 1 vegetation is being needlessly damaged. It could easily be protected by the erection of barriers at each end as the abrupt edges of the old borrow pits for the railway embankment and trapped water during the winter months otherwise provide protection.

Rubbish

Rubbish dating from tip site days is strewn throughout the site. It is important that rubbish be removed to improve the public's perception of the value of the bushland. If rubbish is mixed with weeds and soil they should be carefully removed also. Follow up weed treatment of the removal site might be required.

Unfortunately the neighbour to the west has used their land for rubbish-dumping. Rubbish has been concentrated along the property boundary and is very unsightly. After weeds have been controlled in Condition 5 and 6 areas near the west boundary, screening shrubs such as Grey Parrot-pea and Silver Wattle could be introduced.

Recommendations for restoration and management

Planning

Restoration of bushland is a complex long-term undertaking. To be effective with limited resources, it is crucial to understand the priorities from an ecological perspective and to develop a works program accordingly.

It is most effective and efficient to start with the areas in the best condition (not the most damaged areas) because they can be made resilient with relatively little effort. Much of this bushland is in relatively good condition, but even the best areas are deteriorating, so management of Condition 1 areas must be a priority.

The Endangered Grey Box Grassy Woodland (Plains Woodland EVC) should also be a high priority for restoration.

- **First priority then, will be the Condition 1 Riverine Swampy Woodland and Condition 1 Riverine Grassy Woodland.**
- Second will be Condition 2 Riverine Grassy Woodland.
- Third priority will be Condition 3 Plains Woodland.
- Fourth will be Condition 3 Floodway Pond Herbland and Sedgey Riverine Forest.
- Fifth will be Condition 3 Riverine Swampy Woodland and Riverine Grassy Forest.
- Sixth will be all areas in Condition 4.

The condition of the vegetation will indicate the type of work that will be required. For example (and in general):

- Condition 1 will require careful weeding.
- Condition 2 will require careful weeding after biomass reduction and closer identification of more valuable areas. Less valuable areas will require enhancement after weed treatment.
- Condition 3 will require careful weeding and the addition of seed.
- Condition 4 will require weeding (perhaps using broadleaf herbicide if no vulnerable natives are present) followed by enhancement using seed.

Meanwhile weed control in other areas (Condition 5 or 6) should focus on preventing seed spread rather than eradication using lower effort techniques such as slashing or burning before seed fall. Eventually effort can be put in to controlling weeds and revegetating the lower quality areas.

This approach of starting on the best areas and leaving the worst areas until later is counter-intuitive, but is very effective for successful restoration (it's often referred to as the Bradley method).

The priority of actions to address pest animals, woody weeds, potential vandalism, soil disturbance should be judged according to the impacts of not taking any action and be undertaken when resources are available.

Techniques

Bush regenerators use different techniques to gardeners or amenity land managers. These techniques are developed by understanding the character and habits of the native plants and then designing interventions that advantage the natives over the weeds. For example, actions that support natural seed production, germination and establishment, for example, would be used instead of propagating, planting and watering.

Burning will be an important management tool. Native plants in grassy woodlands are adapted to burning and were managed with fire by aborigines for millennia. Burning can advantage natives by removing competition, reducing pest insects, stimulating growth, stimulating germination and changing soil chemistry and microbiology. Burning can destroy or weaken weeds and destroy weed seed. It can also make weeding much more targeted and effective. Burning must be used judiciously: choose times when the native plants are dormant, when fuel loads and climatic conditions will create a "cool" burn and take measures to protect trees or other sensitive plants.

Weed control will be a major focus of activity. Commercial weed controllers are often expected to kill weeds in one treatment, so that a return visit is not needed. They often have to use more aggressive herbicides because the weeds cannot be treated at the ideal time. Fortunately, the Friends of the ABGS will be able to choose weed control techniques that are less harmful to native species because they can prioritise treating weeds when they are most vulnerable and when native species are less likely to be affected. Staged treatments can be employed such as cutting and bagging seeds until chemical work can be done at the right time or cutting or burning to remove bulk first so that only small amounts of chemical are needed to treat regrowth. If necessary, weed destruction can be quickly followed by revegetation to prevent further weed invasion. If weeds are not all killed by a treatment, at least no natives were needlessly destroyed and follow-up work can easily be scheduled for the following year.

Generally, causes should be treated, not effects. If rabbits are grazing native plants regrowing after fire, for example, harbour destruction and baiting would be far preferable to the construction of a protective fence. It might be that the wetlands (especially the lower quality southern one) are suffering from increased drainage and reduced water collection. A possible solution might be to pump in water in a dry winter, but moisture availability might also be improved by removing many of the young River Red Gums or by removing berms or by blocking drains, which would provide long term remediation.

Skills

The skills required to manage bushland, to identify plants, observe and understand changes, undertake burns, target weeds effectively, control pest animals and collect and sow seed will need to be developed within the ABGS Friends group.

Over time, protocols should be developed for all management activities and the skills of managers should be improved through training workshops and supervised activities.

Simple monitoring and a method for recording the management actions taken and any observations made should be established as soon as possible.

Less complex tasks should be identified and reserved for lower skilled workers after basic instruction. For example, when no skilled workers are available, useful work could still be done collecting rubbish, removing dumped soil, treating woody weeds, cutting and bagging weed seed and so on.

Advertise the restoration actions to visitors as a way of furthering public education and encouraging engagement. For example, use temporary signs to explain why an area has been burnt or what weeds have

been treated and why.

Invite visitors to be involved in the restoration. For example, use seasonal signs to identify weeds and ask visitors to help by pulling any that they see while walking through the bushland.

Summary of recommendations for restoration and management

- Develop a works program based on values and priorities.
- Develop techniques that are effective and appropriate for restoration.
- Develop protocols for management activities.
- Monitor activities and results and adapt accordingly.
- Develop the skills needed to undertake the management required.
- Invite the public to come along on the journey.

Figure 17: an unusual moss amongst Rush Sedge in the Riverine Grassy Woodland

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Appendix 1: List of indigenous plants

The occurrence of each species in the five EVCs present is noted (although many species are likely to be found in more communities over time).

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Scientific name	Common Name	Life Form	Plains Woodland	Riverine Grassy Woodland	Swampy Riverine Woodland	Sedgey Riverine Forest	Floodway Pond Herbland	Significance
Acacia dealbata	Silver Wattle	tree		x		x		
Acacia pycnantha	Golden Wattle	shrub	x					
Alternanthera denticulata	Lesser Joyweed	herb				x	x	
Anthosachne scaber	Common Wheat-grass	grass		x				
Anthosachne kingiana* ssp. *multiflora	Short-awned Wheat-grass	grass		x				"uncommon"
Arthropodium fimbriatum	Nodding Chocolate-lily	lily	x	x				
Arthropodium minus	Small Vanilla-lily	lily	x					
Atriplex semibaccata	Berry Saltbush	subshrub	x					
Atriplex suberecta	Lagoon Saltbush	subshrub					x	
Brachyscome basaltica	Swamp Daisy	herb			x			
Bulbine bulbosa	Bulbine Lily	lily		x				
Caesia calliantha	Blue Grass-Lily	lily		x				"occasional"
Calotis scapigera	Tufted Burr-daisy	herb	x	x	x	x	x	
Cardamine moirensis	Slender Bitter-cress	herb			x		?	Rare in Victoria
Carex appressa	Tall Sedge	sedge		x		x		
Carex gaudichaudiana	River Sedge	sedge	x			x		
Carex inversa	Knob Sedge	sedge	x	x				
Carex tereticaulis	Rush Sedge	sedge			x	x	x	
Centella cordifolia	Centella	herb			x			
Centipeda cunninghamiana	Old Man Weed	herb			x		x	
Chloris truncata	Windmill Grass	grass	x					
Craspedia paludicola	Swamp Billy-buttons	herb			x			
Deyeuxia quadriseta	Reed Bent-grass	grass		x		x		
Dianella admixta	Black-anthered Flax-lily	lily	x					
Dianella tarda	Late-flowering Flax-lily	lily	x	x		x		
Dicanthium sericeum	Silky Blue-grass	grass		x				possibly introduced?
Dichondra repens	Kidney Weed	herb				x		
Dillwynia cinerascens	Grey Parrot-pea	shrub		x		x		

Dysphania pumilio	Crumbweed	herb					x	
Einadia nutans	Nodding Saltbush	herb	x					
Eleocharis acuta	Common Spike-sedge	sedge			x			
Eleocharis pusilla	Small Spike-sedge	sedge			x			
Enteropogon acicularis	Curly Windmill-grass	grass						
Eryngium ovinum	Blue Devils	herb	x	x		x		
Eucalyptus camaldulensis	River Red Gum	tree		x	x	x		
Eucalyptus microcarpa	Grey Box	tree	x					
Euchiton sphaericus	Star Cudweed	herb		x			x	
Eulalia fulva	Silky Brown-top	grass		x				
Euphorbia dallachyana	Caustic Weed	herb	x					
Haloragis heterophylla	Varied Raspwort	herb		x				
Helichrysum luteoalbum	Jersey Cudweed	herb	x	x		x	x	
Hypericum gramineum	Small St. John's Wort	herb		x				
Juncus subsecundus	Finger Rush	rush	x	x				
Juncus amabilis	Rush	rush					x	
Juncus sp3	Rush	rush					x	
Juncus sp4	Rush	rush				x		
Lachnagrostis filiformis?	Blown Grass	grass			x			
Linum marginale	Austral Flax	herb		x	x			
Lobelia concolor	Poison Pratia	herb	x					
Lomandra filiformis	Wattle Mat-rush	rush	x					
Lycopus australis	Austral Gypsywort	herb					x	
Marsilea costulifera	Narrow-leaf Nardoo	fern			x			
Mentha australis	River Mint	herb				x		
Mentha satureioides	Native Pennyroyal	herb	x	x		x		
Oxalis perennans	Grassland Wood-sorrel	herb		x				
Oxalis exilis	Wood Sorrel	herb				x	x	
Paspalidium jubiliflorum	Warrego Summer-grass	grass		x	x	x	x	
Persicaria decipiens	Slender Knotweed	herb					x	
Persicaria hydropiper	Water Pepper	herb					x	
Persicaria prostrata	Creeping Knotweed	herb					x	
Pimelea curviflora	Slender Riceflower	subshrub	x			x		
Poa labillardieri	Common Tussock-grass	grass		x		x		
Pseudoraphis spinescens	Moira Grass	grass			x		x	
Ranunculus lappulacea	Australian Buttercup	herb		x				"rare in lowlands"
Ranunculus sessiliflorus	Annual Buttercup	herb	x	x				
Rumex brownii	Slender Dock	herb	x			x		
Rytidosperma duttoniana	Brown-back Wallaby-grass	grass	x		x			
Rytidosperma linkii	Copper-awn Wallaby-grass	grass	x	x				
Rytidosperma semiannulare	Wetland Wallaby-grass	grass		x				2nd record for region

Rytidosperma setacea	Bristly Wallaby-grass	grass	x			x	
Senecio quadridentata	Cotton Fireweed	herb	x	x	x	x	x
Sida corrugata	Variable Sida	subshrub	x				
Solenogyne dominii	Smooth Solenogyne	herb	x	x			
Themeda triandra	Kangaroo Grass	grass		x			
Tricoryne elatior	Yellow Grass-lily	lily					
Wahlenbergia fluminalis	River Bluebell	herb		x	x		
Wahlenbergia luteola	Yellowish Bluebell	herb		x			
Wurmbea dioica	Early Nancy	lily	x				

Appendix 2: List of weeds

Ref: Flora of Victoria. [ONLINE] Available at: https://vicflora.rbg.vic.gov.au/. [Accessed 1 September 2017].

Please note that as this survey was undertaken in August, many plants could not be identified to species level (indicated by "sp." or ?), so this list must be considered a first draft that will be updated as more information becomes available. This list is not exhaustive.

Weeds are classified here as requiring control if they are competitive and will slowly spread or as a priority for control if they are competitive and likely to spread rapidly.

Scientific Name	**Common Name**	**Life form**	**Action required**	**Noxious Weed in Victoria**
Arctotheca calendula	Capeweed	herb annual		
Cirsium vulgare	Spear Thistle	herb annual	control	
Cotula bipinnata	Ferny Cotula	herb annual		
Cyperus eragrostis	Nut Grass	sedge perennial	control	
Echium plantagineum	Paterson's Curse	**herb biennial**	**priority control**	Reg controlled
Ehrharta longiflora	Annual Veldt-grass	grass annual	control	
Epilobium sp.	willow-herb	herb perennial	control	
Erigeron bonariensis	Flax-leaf Fleabane	herb annual		
Fraxinus angustifolia	Desert Ash	tree	control	
Fumaria muralis	Wall Fumitory	herb annual		
Galanthus plicatus	Snowdrop	lily perennial	control	
Galium aparine	Cleavers	herb annual		
Piptatherum milliaceum?	Rice Millet	grass perennial	control	
Hypericum perforatum	**St. John's Wort**	**herb perennial**	**priority control**	Reg controlled
Hypochoeris radicata	Flat Weed	herb perennial		
Lactuca saligna	Wild Lettuce	herb annual		
Lepidium africanum	Common Pepper-cress	herb perennial	control	
Lolium rigidum	Wimmera Rye-grass	grass annual		
Lycium ferocissimum	African Boxthorn	shrub	**priority control**	Reg controlled
Modiola caroliniana	Red-flowered Mallow	herb perennial	control	
Narcissus jonquilla	Jonquil	lily perennial	control	
Nothoscordum gracile	False Onion weed	lily perennial	control	
Olea europaea	Olive	tree	**priority control**	
Oxalis pes-caprae	Soursob	herb perennial	**priority control**	State restricted
Panicum coloratum	**Coolah Grass**	**grass perennial**	**priority control**	
Paspalum dilatatum	**Paspalum**	**grass perennial**	**priority control**	
Phalaris canariensis	Phalaris	grass perennial	control	
Phoenix canariensis	Canary Island Palm	tree	control	
Phyla nodiflora	**Lippia**	**herb perennial**	**priority control**	
Plantago lanceolata	**Ribwort**	**herb perennial**	**priority control**	
Prunus cerasifera	Cherry Plum	tree	**priority control**	

Ranunculus muricatus	Sharp Buttercup	herb annual	control	
Romulea rosea	Onion Grass	lily perennial		
Rosa rubiginosa	Sweet Briar	shrub	**priority control**	Reg controlled
Rumex crispus	Curled Dock	herb perennial	control	
Solanum nigrum	Black Nightshade	herb annual	**priority control**	
Solanum pseudocapsicum	Madiera Winter Cherry	shrub	**priority control**	
Sonchus oleraceous	Common Sow-thistle	herb annual		
Spergularia rubra	Pink Sand-spurrey	herb perennial		
Stellaria pallida	Lesser Chickweed	herb annual		
Verbena officinalis	Common Verbena	herb perennial	**priority control**	
Veronica hederifolia	Ivy-leaf Speedwell	herb annual		
Vicia sp. 1	a vetch	herb annual		
Vicia sp.2	a vetch	herb annual		
Xanthium occidentale	NoogooraBurr	herb annual	**priority control**	Reg controlled
Xanthium spinosum	Bathurst Burr	herb annual	**priority control**	Reg controlled

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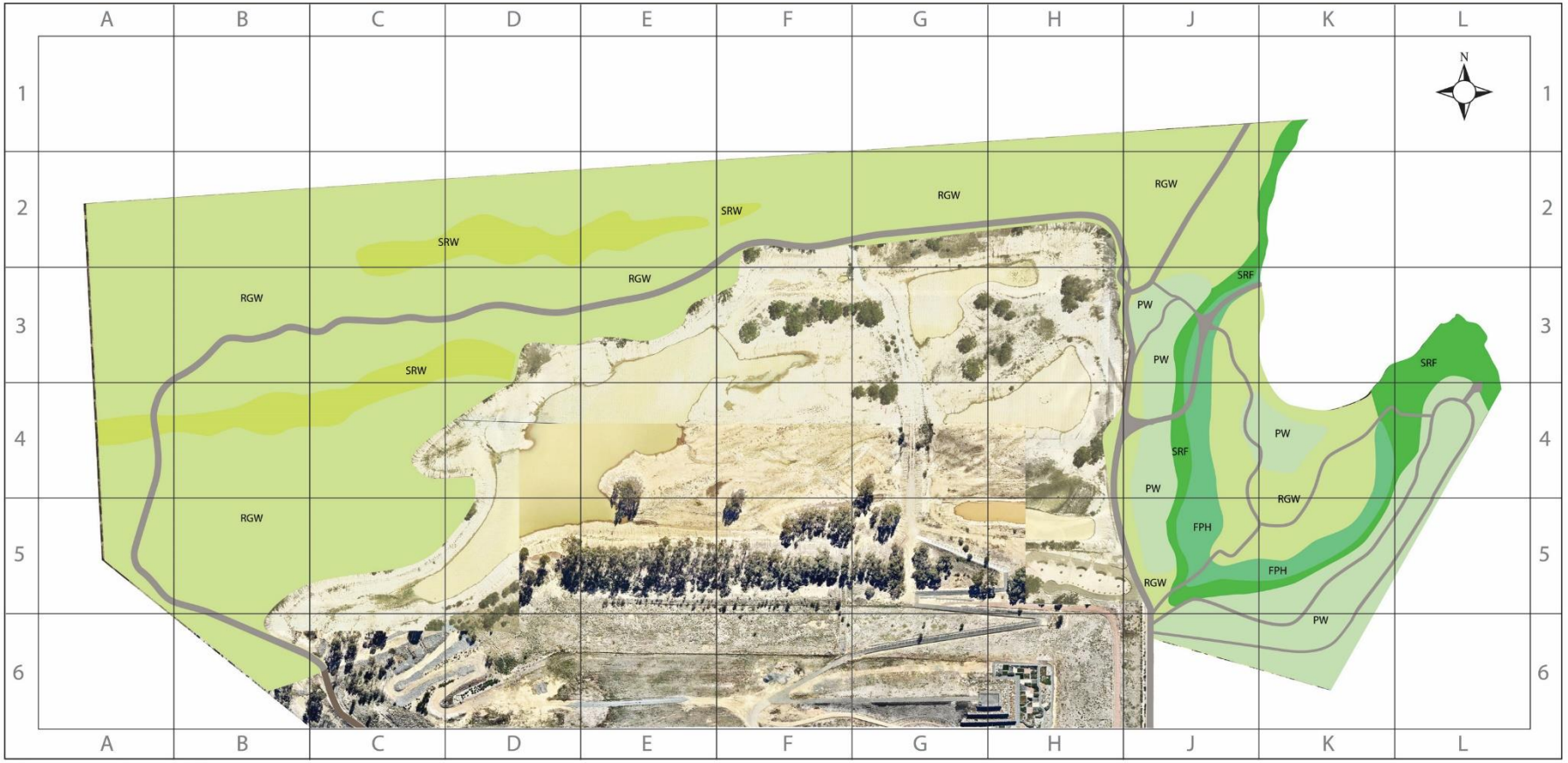


Vegetation Class Appendix 3

- Plains Woodland EVC
- Riverine Grassy Woodland EVC
- Swampy Riverine Woodland EVC
- Sedgey Riverine Forest EVC
- Floodway Pond Herbland
- Existing Tracks

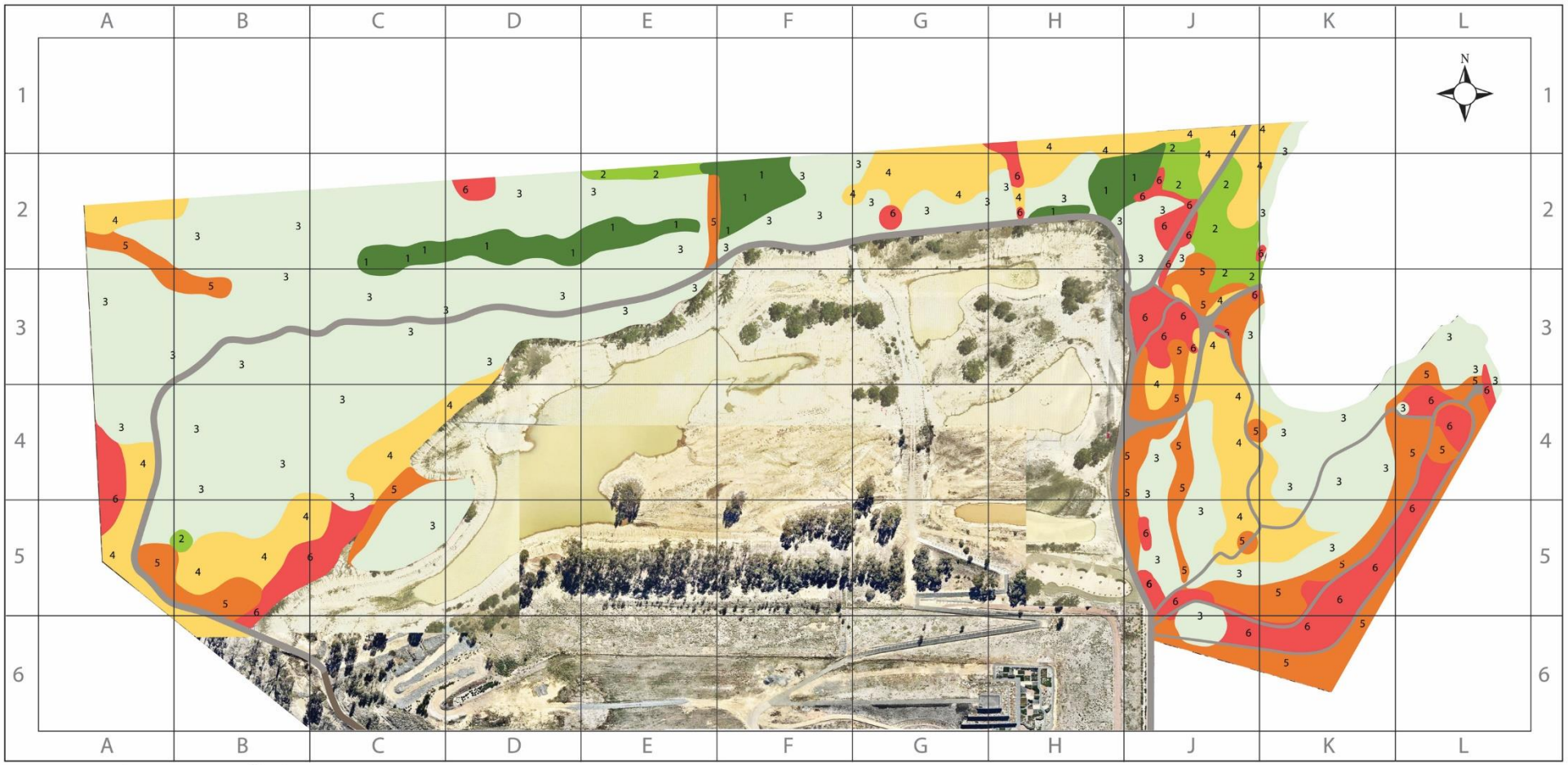
Digitised map of EVC's and Vegetation Condition was created for the Friends of the Australian Botanic Gardens Shepparton by Cheryl Clark May 2018, based on Sally Mann's Vegetation survey and classification May 2018.

Page: Size A2
Date Compiled: June 2018

The map has been compiled from a montage of digital and scanned images and is NOT to scale.

0 10 20 30 40 Meters
Approx.
Guide only

Australian Botanic Gardens Shepparton - Natural Vegetation Survey 2018



Vegetation Condition Appendix 4

Condition 1
High diversity
More natives
Less weeds

Condition 2
High diversity
Half natives
Half weeds

Condition 3
Moderate diversity
More natives
Less weeds

Condition 4
Moderate diversity
Half natives
Half weeds

Condition 5
Low diversity
Less natives
More weeds
Mostly annual grasses

Condition 6
Low diversity
Less natives
More weeds
including perennials

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