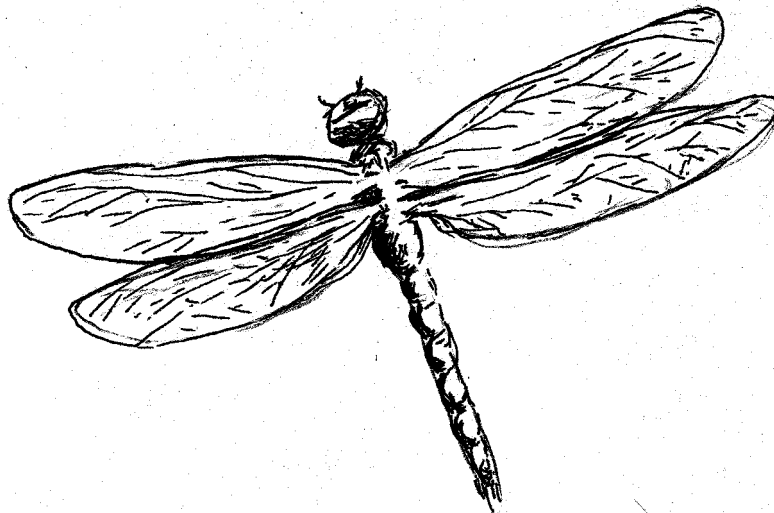


NEIL MCDOUGALL

Lake revegetation and landscaping project



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1.0 Introduction

Following our meeting at Neil McDougall Park I am pleased to offer the following advice and information. This text confirms the discussions we have had during the site visits and provides you with a more detailed record for future use.

The following report details the species selection, site preparation, recommended planting densities and maintenance of any works undertaken. The arrangement of the species and numbers are also estimated.

After species selection there are two important considerations with revegetation: weed control and maintenance. These factors limit the extent of the plantings and the recommended minimum density of those plantings. As with any planting program, good preparation and ongoing maintenance are the keys to success.

2.0 Rehabilitation zones and recommendations

2.1 General recommendations

The objective of this revegetation and landscaping program is to recreate low sedgeland, closed heathland and to provide wildlife corridors to the lake for turtles and waterbirds. All of this is intended to improve the naturalness of the site, while providing an aesthetically pleasing outlook over the lake.

2.1.1 Buffer strip

The establishment of a buffer strip (in this case proposed kerb) between turf areas and the wetland or landscape areas is of great importance. If kerbing is considered too costly, the buffer could simply be a 1 m wide mulch band which can be maintained by spraying. It will be important to consider drainage and surface water flow from the tracks.

Buffer strips should be used anywhere there is a line between bushland and parkland. Such defined boundaries make it clear to mowing staff working on the park that the management objectives are different on each side.

2.1.2 Waterbird habitat

Woody debris with fine branches and branchlets could be placed in their entirety into the water, so that some of the branchlets protrude above the surface. By fully immersing dead trees, it is possible to provide habitat for aquatic invertebrates such as water beetles and other larvae and also provide shelter and protection for tadpoles, juvenile fish and other animals. The material above the water will provide roosting sites for diving birds such as cormorants, anchorage sites for grebe nests and possibly nesting sites for other birds.

Some woody debris could extend from the shoreline into the water to provide access for terrestrial animals and basking spots for native turtles.

Note that woody tree weeds containing significant amounts of seed should not be used e.g. Victorian coastal teatree, Casuarina and Japanese pepper. Any willow prunings should be removed from the site as they can grow from small fragments.

2.1.3 Turtle breeding pens

The City has endeavoured to provide breeding areas for turtles in the past. These areas were fairly densely vegetated and there is limited shelter for turtles making their way to and from the breeding nodes. A proposed new design for the turtle shelters is attached (Appendix 3). The shelters could be constructed out of black steel and then be left to rust or built of steel pre-treated to look rusty and then stabilised. Alternatively, they could be galvanised. Galvanised would be reflective and shiny for a period of time and then with dust and rain would lose its sheen.

The centre of the pens should be left as predominantly bare sand with *Ficinia (Isolepis nodosa)* spaced about 1.5 metres apart. The vegetation surrounding the pens should be predominantly *Hypocalymma robustum* and *Hypocalymma angustifolia* which will provide shelter without blocking the movement of turtles. Some stands of rushes and sedges could be used to help guide the turtles.

The design of the steel panels takes into account the impact of the thermal mass of the steel and cross ventilation, as well as safety requirements. The set-up off the ground will enable turtles to pass beneath but is too narrow for small children.

2.1.4 Weed control and treatment

Weed control is necessary prior to planting around the lake, although it is feasible to plant emergent rushes close to the low water mark prior to effective weed control along the bank.

Physical removal of the turf is feasible and would minimise the need for broadscale herbicide use.

2.1.5 Plant establishment

Rushes and sedges

Wetland plants, particularly emergent rushes and sedges should be planted between October and March to maximise the rate of establishment and enable the plants to be sufficiently well-rooted and gain sufficient height prior to the onset of winter.

Rushes and sedges senesce (i.e. do not grow new leaves) over winter which makes them vulnerable to removal by waterbirds or wind waves. Planting between April and September is only recommended when using 300 or 600 mm 'U'-shaped pegs and using large stock. Those species that are recommended for the shallow margins of the lake can be planted in winter, provided they are pegged. It is important that anything planted at this time of year is less than 100 mm below high water mark.

The plants grow more readily in warm weather and do better once the water temperature rises. If the plants are provided in a combination of plant sizes, use the larger plants to shield the smaller ones.

As outlined below, all wetland plants should be installed in groups of the same species – which emulates the way they live in the natural environment. This supports the plants and increases their rate of establishment. Gaps should be left between different species groups to allow the plants to spread and come to their own competitive balance.

Herbivory is likely to be a significant issue and a range of techniques including tree guards, mesh cages, mesh pens have been trialled with varying success in the past. Some techniques resulted in inadvertent bird deaths – particularly diving birds and swans that

feed off the lake bed and tried to forage for the rhizomes of the emergent rushes. The *Baumea articulata* (Jointed twig rush) persisting in the lakes are the only survivors.

Trees and shrubs

The natural vegetation that occurs on the lake margins can be extended and provide a wildlife corridor to enhance the environmental aspects of the park. Extending the existing thickets will encourage wrens, honeyeaters and other small shrubland birds to utilise the area. Dense low shrubs, such as myrtles with surrounding rushes would be ideal in this area. This type of vegetation community will also support turtle movement.

Any plantings of the larger paperbarks should be focussed on individual *Melaleuca preissiana* and groups of *Melaleuca raphiophylla*.

3.0 Site specific suggestions

3.1 The lake

To maintain a number of viewsapes, a simple planting design is suggested. This would focus on having three dominant sedge species planted in sequence upslope. A number of water access points have been maintained.

The recommended planting density is 0.6 metre for all species. The planting area has been divided into nodes which are numbered on the plan. A schedule of quantities is provided in Appendix 2.

The only potential issue aside from herbivory is the risk of drowning if the water level is not reduced by pumping. Based on discussions held at the site, it is possible that the revegetation areas could potentially be inundated for more substantial periods of time than has occurred in the past. This will need to be closely monitored in heavy rainfall years with a strategy developed to ensure water levels can be reduced if required.

3.1.2 Recommendations for management

Weed control

The preferred method for weed control around any regenerated seedlings is hand weeding or selective spraying while protecting the seedling. Where weed removal may result in disturbing an adjacent native seedling, it is easier to wick wipe the leaf surfaces of the weed with Glyphosate to facilitate control. Appropriate species to speed up the rate of vegetation growth are listed below and in Appendix 1.

Suitable species for revegetating the banks include:

Wetland species	Common name	Max water depth	Plant height
Deeper water species			
<i>Typha domingensis</i>	Cumbungi	0 - 0.4 m	< 2 m
<i>Baumea preissii</i>	Broad twig sedge	0 – 0.2 m	< 1.5 m
<i>Baumea articulata</i>	Joint leaf sedge	0 – 0.6 m	< 2 m
Shallow water/waterlogging tolerant			
<i>Juncus pauciflorus</i>	Loose flowered rush	0 – 0.2 m	1.2 m

<i>Juncus kraussii</i>	Shore rush	0 – 0.1 m	1.5 m
<i>Lobelia alata</i>	Angled lobelia	HWM	Groundcv

Dryland species	Common name	Plant height
<i>Baumea juncea</i>	Bare twig sedge	1.2 m
<i>Carex tereticaulis</i>		1.2 m

3.1.3 Boardwalk areas – future revegetation opportunities

Opportunities exist to revegetate the areas adjacent to the proposed boardwalks to the south-east and west of the lakes. The entire south-east corner of the lake could be revegetated with deep water tolerant species such as *Baumea articulata* up to the boundary marked by the proposed boardwalk. This will provide valuable wildlife habitat and contribute to improving the water quality of the lake by functioning as a nutrient sink. The water column will be shaded by the tall rushes which will reduce algal growth.

The western drainage inlet could be landscaped as a living stream whereby water from the inlet is filtered through rock and vegetation beds before entering the lake for the purpose of improving water quality. Open low rock weirs could be constructed to dissipate the flow and spread it evenly across the drainage line. The sections between these rock weirs would be vegetated. Such an approach could achieve two goals:

- improve wildlife habitat and aesthetics and
- stripping sediment by reducing water velocities and potentially trap some dissolved nutrients.

Species tolerant of extended periods of waterlogging such as *Baumea articulata* could be used. Some earthworks may be required to set optimal gradients and channelling of the input water.

Revegetation of both of these areas should take place following boardwalk construction to minimise damage to plantings. It will be necessary to undertake an engineering assessment to ensure drainage function is not compromised. Slowing flow excessively could result in the water banking up in the stormwater system, which could flood adjacent residential areas.

3.2 The lake garden beds

The second phase of revegetation will be to achieve more extensive vegetation cover around the lake and also to vegetate and stabilise the two seep zones. Some portions of this may prove difficult to establish plants in, as depositing soil from the lake construction has substantially changed the natural soil strata.

Inadequate weed control poses the most substantial threat to the survival of the wetland plants and the success of the project. It is critical that weed control is undertaken regularly and comprehensively around the revegetation plantings.

The original quote did not include the development of landscape designs for gardens/habitat zones beyond the lake margins, however, a list of suitable species is provided below. Should further drawings or details be required please do not hesitate to contact our organisation.

3.2.1 Site preparation

Prior to undertaking planting it is important to hand weed or slash and poison the grasses in the areas to be planted. If you are intending to herbicide treat the areas prior to planting, you should start in winter and then re-treat any growth as it occurs in spring and summer.

Any areas of grass that co-occur with small numbers of native rushes, such as Pale rush, should be treated with Fusilade in December and February to help these native plants colonise neighbouring areas. Treating the area between December and February will minimise the threat to frogs in the area – as it is generally between their breeding seasons.

3.2.2 Species selection

Suitable species for revegetating the lake surrounds where watering occurs include:

Wetland species – shrubs and trees	Common name	Max water depth	Plant height
<i>Agonis linearifolia</i>	Swamp peppermint	0.1 m	3 m
<i>Agonis parviceps</i>		Waterlogged	3 m
<i>Anigozanthos flavidus</i>	Tall kangaroo paw	0 – 0.1 m	< 1.5 m
<i>Astartea fascicularis</i>	Common Astartea	0.1 m	2.5 m
<i>Banksia littoralis</i>	Swamp banksia	Waterlogged	< 10 m
<i>Hypocalymma angustifolia</i>	White myrtle	0.1 m	1.5 m
<i>Melaleuca preissiana</i>	Moonah	0 – 0.1 m	8 m
<i>Melaleuca raphiophylla</i>	Freshwater paperbark	0 – 0.3 m	5 m

Optional species for heath and shrubby surrounds to frame the view include:

<i>Calothamnus sanguineus</i>	<i>Verticordia grandiflora</i>	<i>Grevillea diversifolia</i>
<i>Grevillea vestita</i>	<i>Kunzea recurve</i>	<i>Regelia inops</i>
	<i>Oxylobium lineare</i>	<i>Dianella revoluta</i>
<i>Orthrosanthus laxus</i>	<i>Patersonia occidentalis</i>	<i>Verticordia nitens</i>
<i>Hypocalymma angustifolia</i>	<i>Grevillea thelemanniana</i>	<i>Grevillea 'Gingin gem'</i>
<i>Verticordia spp.</i>	<i>Myoporum parvifolium</i>	<i>Hakea spp.</i>
<i>Banksia menziesii 'Dwarf'</i>	<i>Kennedia prostrata</i>	<i>Scholtzia involucreta</i>
	<i>Hardenbergia comptoniana</i>	

It may be worth using a few cultivars such as *Astartea* 'winter pink' in the short term to maximise the aesthetic appeal of the site. All of the species listed are able to tolerate full sun conditions, however it is a limited list as it is beyond the scope of the original quote.

The arrangement of these species would need to be discussed after you have had some time to think about options, and have visited a nursery to view these plants.

3.2.2 Recommendations for management

- Ensure that all future management activities are designed to minimise damage to the banks. For instance, do not attempt to remove the rhizomes from the weed species that have extensive root systems as this can lead to soil instability.
- Ensure that Fusilade is not used over **running** water as it has serious implications for waterway health.

- Use Fusilade during December to February. This reduces the potential impact on frogs, birds and other wildlife breeding in wetlands.

4.0 Planting Advice

4.1 Species recommendations

For all areas, the most effective revegetation technique tends to involve planting nodes of different species densely, to exclude weeds by competition and then joining these nodes together.

For example, by planting islands of densely planted rushes with clusters of shrubs and occasional trees you can reduce maintenance and improve the soil structure. Each group of densely planted nodes can be linked by lower density plantings. Densely planted islands of vegetation reduce the cost of maintenance in the longer term by excluding weeds.

Recommendations

- Plant only as many trees as can be effectively managed within the park.
- Plant riparian vegetation in high density nodes; and then join the clumps together.
- Support regenerating and planted trees to restore dense canopy cover thereby reducing weed invasion.
- Focus new plantings in areas where weed control is being undertaken; and ensure that weeds are regularly removed from around the tubestock.
- In areas where introduced grasses are present has been implemented, use only the selective herbicide Fusilade. This chemical will minimise any detrimental effects on the seeded species.

4.2 Supporting natural regeneration

There are considerable opportunities to use natural regeneration as the dominant management technique for the park. Careful weed control is likely to encourage native vegetation to regenerate, as new environments become available following weed control.

Weed control should be focused around existing clumps of native vegetation, to enable the natural spread of these plants. This is particularly important for the rushes and sedges. Intense competition by the Kikuyu and Couch affect the way these plants grow.

Recommendations

- Identify and tag populations or individual representatives of native species to assist in focusing weed control work.
- Focus weed control around seedlings and germinants to encourage rapid growth and prevent smothering by weeds.

- Establish a chemical break to control turf grasses and reduce weed invasion into the riparian vegetation.
- Spray a 1 - 2 m wide buffer of Fusilade around individual clumps of rushes in the seep zones to encourage these plants to spread naturally.

4.3 Plant supply

When proposing to use rushes and sedges, larger stock is recommended for emergent zones to buffer smaller stock on the water's edge. Sufficient root ball is required to enable the plants to be pegged to the substrate using a 300 mm U-shaped steel peg. This reduces plant loss as the result of herbivory. Many wetland birds, particularly Purple swamp hens like feeding on the rhizomes of many sedge species. In doing this, they pull the plants out of the ground. Also, where plants are subjected to wind waves, the smaller ones are likely to float out of the ground.

Ideally, plants will be grown by the City nursery using locally collected seed stock. There will be a lead time of a year for plants to be grown to a suitable size and condition and to suit planting times.

If proposing to purchase plants from an external nursery, information about seed, plant and soil provenance should be requested. Many nurseries are importing plant material and small seedlings from the Eastern States – which has resulted in local gene pools being contaminated with non-local stocks and the introduction of new pathogens. While it may not be possible to get all of the relevant information or stock from the immediate area, it may help to protect the park from inadvertent contamination.

5.0 Weed control

A list of weed control information is provided in Appendix 2 of this document. If any additional information is required please do not hesitate to contact me.

5.1 Introduced grasses – annual and perennial

The annual and perennial grasses present at the property can be effectively managed using Fusilade in areas with native vegetation at a rate of between 2l/ha and 4l/ha (refer Appendix 2). In areas with no native vegetation, the non-selective herbicide Glyphosate can be used. Fusilade can be used safely during summer on the margins of wetlands, although extreme care should be taken to not spray it into any moving water. Between January and February, the frog populations tend to have finished their breeding cycle and are more mobile. This is the preferred time to use Fusilade – when the risk of affecting non-target species is at its lowest.

Once control is achieved, it is feasible to use Roundup Biactiv (Glyphosate) to maintain the buffer.

Chemicals need to be used in accordance with the manufacturer's instructions, and adequate safety apparel must be worn.

Please check with your relevant local authorities prior to applying any chemical around water. Some chemicals are unsuitable for use in or around waterways.

6.0 Timelines for implementation

The following times are recommended for the activities discussed above.

MONTH	ACTIVITY
September 2006	Mechanically scrape areas to remove grasses from turtle enclosures and leave bare to enable ongoing selective removal of any weeds.
October 2006	Plant large stock in lakes – towards low water mark. Install turtle enclosures and fill central portion with bare sand. Plant <i>Ficinia nodosa</i> at recommended spacing.
November 2006 – January 2007	Nursery and/or bushcrew staff to collect seeds for revegetation species.
January 2007	Sow seeds collected, purchasing additional seeds as necessary. If there are any issues with propagation, place a preliminary order with external nurseries. It is essential to provide external nurseries with sufficient lead time to grow stock to ensure that it is available and in good condition when required.
February 2007	Treat perennial grasses (kikuyu and buffalo) in existing rush beds using a grass specific herbicide. Hand weed any broadleaf weeds present within the park. Paint <i>Cyperus</i> and other weeds that are interspersed with rush and sedge beds with Roundup Biactive in damp areas, but not over running water. Determine alignment of lake revegetation strips and mark prior to works occurring. To restrict public and dog access to revegetation areas it may be necessary to install temporary fencing such as bunting or star pickets with caps and plastic coated wire. Appropriate signage describing the proposed works should be installed to facilitate public understanding and acceptance of the works.
March 2007	Continue to spot spray as required. Spray out lake buffer revegetation areas with a systemic herbicide like Glyphosate. Follow up with another spray 10 days later if necessary.
April 2007	The lake water level should be at its lowest so use the opportunity to mechanically scalp the revegetation areas to remove dead lawn from March sprayings.
May 2007	Treat annual grasses (if rain has resulted in germination) in areas where

	<p>planting is proposed.</p> <p>Hand weed any broad leaf weeds, which germinate following the break of the season.</p> <p>Plant tubestock in garden beds and rehabilitation zones beyond high water mark.</p>
June 2007	<p>Plant tubestock in garden beds and rehabilitation zones beyond high water mark.</p> <p>Treat annual grasses in areas where planting or direct seeding is proposed.</p> <p>Hand weed and broad leaf weeds which germinate now.</p>
July 2007	<p>Plant tubestock in gardens beyond high water mark.</p> <p>Treat annual grasses in areas where planting is proposed.</p> <p>Hand weed any broad leaf weeds which germinate now.</p>
August 2007	<p>Spray any regenerating weeds.</p>
September 2007	<p>Tag native species and hand weed or selectively spray around them to reduce competition.</p> <p>Mechanically scrape areas to remove grasses from turtle enclosures and leave bare to enable ongoing selective removal of any weeds.</p>
October 2007	<p>Tag native species and hand weed around them to reduce competition.</p> <p>Plant tubestock in lakes – between median to high water mark.</p> <p>Plant <i>Ficinia nodosa</i> at recommended spacing.</p>
November 2007	<p>Brushcut <i>Cyperus</i> and other weeds to prevent flowering process.</p> <p>Plant tubestock on lake margins where weed control has been successful.</p> <p>Plant emergents and install barriers to protect them from waterbirds.</p>
December 2007	<p>Spray <i>Cyperus</i> regrowth resulting from brushcutting.</p> <p>Focus weed control on creating a buffer around existing native plants – either tubestock or natural regeneration.</p>

* this may vary across these months depending on the break of the season.

Appendix 1: Weed control specifications

Common name	Scientific name	Chemical and rate	Specifications	Comments
African lovegrass Wild oats Other annual grasses	<i>Eragrostis curvula</i> <i>Avena fatua</i>	Glyphosate 360g / litre Glyphosate 450g / litre Glyphosate + Oust®	KNAPSACK: amount of product per 10 litres / 100m ² : 20-40 ml RATE OF PRODUCT / HA : 2 – 4 litres WETTING AGENT DILUTION: 0.25% TIME OF APPLICATION: June / July KNAPSACK: amount of product per 10 litres / 100m ² : 15 – 30 ml RATE OF PRODUCT / HA : 2 – 4 litres WETTING AGENT DILUTION: 0.25% TIME OF APPLICATION: June / July KNAPSACK: amount of product per 10 litres / 100m ² : 20 – 50 ml Glyphosate + 2 – 3 g Oust® RATE OF PRODUCT / HA : 2.5 litre Glyphosate + 200-300g Oust® WETTING AGENT DILUTION: 0.25 – 0.5% TIME OF APPLICATION: June / July	Sometimes mixing with water improves result. Do not use where native plants are present. Spraying young shoots is more effective.
Kikuyu Paspalum Buffalo	<i>Pennisetum clandestinum</i> <i>Paspalum dilatatum</i> <i>Stenotaphrum secundatum</i>	Fusilade®	KNAPSACK: amount of product per 10 litres / 100m ² : 15-20 ml RATE OF PRODUCT / HA : 1.5 - 2 litres WETTING AGENT DILUTION: 0.25% TIME OF APPLICATION: while weed is actively growing	Possible alternatives are tetrapion and Glyphosate.
Dock	<i>Rumex spp.</i>	Hand weed carefully. Ally®	KNAPSACK: amount of product per 10 litres / 100m ² : 0.05 g RATE OF PRODUCT / HA : 5 g WETTING AGENT DILUTION: 0.25 – 0.5 % TIME OF APPLICATION: while weed is actively growing	Where the dock is amongst native plants, herbicide should be wiped onto the leaves carefully as it will damage rushes.

Common name	Scientific name	Herbicide	Suggestions	Comments
Veldt grass	<i>Ehrharta calycina</i>	Fusilade	KNAPSACK: amount of product per 10 litres / 100m ² : 20-40 ml RATE OF PRODUCT / HA: 2 - 4 litres WETTING AGENT DILUTION: 0.25% TIME OF APPLICATION: full leaf growth present	Use in bush areas where native plants persist.
		Glyphosate	KNAPSACK: amount of product per 10 litres / 100m ² : 15 – 30 ml RATE OF PRODUCT / HA: 2 – 4 litres WETTING AGENT DILUTION: 0.25% TIME OF APPLICATION: June / July	Use for dense stands or areas with limited native vegetation.
Assorted broadleaf weeds		Lontrel	RATE OF PRODUCT / HA: 700ml - 1 litre WETTING AGENT DILUTION: 0.1 %	Effective on broadleaf weeds amongst native vegetation – wick wipe or careful spraying

Appendix 2: SCHEDULE OF QUANTITIES

Plant quantities were calculated based on revegetation areas, appropriate plant densities and species composition using the spreadsheet “quantities.xls”.

Wetland Plants	Proportion (%)	Spacing (m)	Density (plants/m ²)	Reqd plant numbers
<i>Baumea articulata</i>	10	0.6	3.5	830
<i>Baumea juncea</i>	20	0.6	3.5	1670
<i>Baumea preissii</i>	30	0.6	3.5	2500
<i>Carex tereticaulis</i>	10	0.6	3.5	830
<i>Ficinia nodosa</i>	10	0.6	3.5	830
<i>Juncus kraussii</i>	5	0.6	3.5	420
<i>Juncus pauciflorus</i>	10	0.6	3.5	830
<i>Lobelia alata</i>	5	1	1.3	150
<i>Typha domingensis</i>	3	0.6	3.5	250
	103		Total	5000

The plant quantities are divided amongst the different areas using the following proportions (“Wetland area proportion (%)” column).

	Description of area	Length (m)	Actual area wetland (m ²)	Wetland area proportion (%)
1	Drain north side	25	60	2.5
2	Drain south side	45	90	3.8
3	new turtle nesting area	85	245	10.4
4	east of shelter	130	1300	55.2
5	beyond boardwalk	35	140	5.9
6	northeast node	60	300	12.7
7	northeast node	80	160	6.8
8	western node	40	60	2.5
	Totals	500	2355	

Appendix 3:

TURTLE ENCLOSURE AND VIEWING PLATFORM